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PESTICIDE MOVEMENT FROM CROPLAND INTO LAKE ERIE

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Concentrations of residues in the few positive analyses were generally less than 10 parts per billion for detected insecticides and less than 50 ppb for triazine herbicide. Diazinon, dieldrin, and the DDT family of compounds were the most common insecticides detected. Atrazine was the most often detected herbicide. An indication of chlorophenoxy and herbicide residue in one water and one bottom sediment sample was very questionable. The insecticide residues were generally associated with bottom sediment, whereas atrazine was associated with both water and sediment samples.

The association of pesticide residues with particular river sites and sampling periods was inconsistent although limited correlation between residue occurrence and the early spring agricultural soil preparation and planting season was observed at one or two sites on two rivers. No valid basis was provided to adequately assess the agricultural versus municipal sources of pesticide contamination. During the period of this study, it appeared that pesticide contamination of northern Ohio rivers was negligible and the contribution to pesticide pollution of Lake Erie was insignificant. (EPA)

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PESTICIDE MOVEMENT FROM CROPLAND INTO LAKE ERIE

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ABSTRACT

Gas chromatographic analysis of water and bottom mud sediment samples collected monthly during a one-year period from sites on the Maumee, Portage, Sandusky, Huron, and Grand River systems indicated only very infrequent and sporatic occurrence of minute concentrations of pesticide residues. Samples were analyzed for organochlorine and organophosphate insecticides and for triazine and chlorophenoxy acid herbicides.

Concentration of residues in the few positive analyses were generally less than 10 parts per billion for detected insecticides and less than 50 ppb for triazine herbicide. Diazinon, dieldrin, and the DDT family of compounds were the most common insecticides detected. Atrazine was the most often detected herbicide. An indication of chlorophenoxy acid herbicide residue in one water and one bottom sediment sample was very questionable. The insecticide residues were generally associated with bottom sediment, whereas atrazine was associated with both water and sediment samples.

The association of pesticide residues with particular river sites and sampling periods was inconsistent although limited correlation between residue occurrence and the early spring agricultural soil preparation and planting season was observed at one or two sites on two rivers. No valid basis was provided to adequately assess the agricultural versus municipal sources of pesticide contamination. During the period of this study, it appeared that pesticide contamination of northern Ohio rivers was negligible and the contribution to pesticide pollution of Lake Erie was insignificant.

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SECTION

CONCLUSIONS

Based upon the experimental design and the analytical results of this study, the contribution of agricultural and municipal sources to the pesticide residue pollution of Lake Erie in 1971-1972 was negligible and insignificant. The results of the study provided no real basis for comparing the pesticide pollution contribution from agricultural use of pesticides to that attributed to municipal, residential, and industrial use. Termination of the study after only one year of sample collection seriously curtails the reliability of making any valid evaluation of the actual situation. A certain percentage of the experience, technique, and data of the first year could have very profitably been utilized in making adjustments so that subsequent year's procedures, etc., would have provided for more valid and meaningful evaluation.

The data indicate that at the times of the sampling on the five rivers there were no significant problems with pesticide contamination. The very few positive residue values obtained for atrazine or simazine at generally less than 50 ppb and for diazinon and dieldrin at less than 10 ppb indicated some association of residue in the streams during the spring soil preparation and corn planting season. If pesticide residues were to drain from agricultural land due to runoff from rainfall, etc., this is one particular season of the year that some contamination of water ways could be expected because it is the season during which a large percentage of pesticides are used and the vegetative cover offering protection from soil erosion during rainfall is at a minimum. Only in the case of occurrence of triazine herbicides was there noticeable correlation of residues between water and bottom sediment samples and with subsequent sampling at the particular sites at the later 2 week or 1 month interval.

The data obtained in this study produced no indication of pesticide pollution problems from any of the insecticides and herbicides involved. Generally the insecticides from these categories that might be of concern because of use in Ohio agriculture are aldrin-dieldrin, heptachlor-heptachlor epoxide, diazinon, and parathion. Triazine, 2,4-D and dicamba herbicides are used in weed control programs. DDT and consequently its metabolities and 2,4,5-T are no longer used in Ohio agriculture and in fact have had very limited previous use for a period of several years. Residential use of all of these materials would be considerably curtailed because of recommendations and restrictions. Some industrial use in municipalities might occur. In most cases, pesticide residues could be present in the streams originating from agricultural land only in period of excessive rainfall and subsequent movement of soil into the streams through runoff.

As indicated previously, the data provide no basis for assessing the contribution of agricultural versus municipal, residential, and industrial sources to pesticide pollution of waterways. Nor with the limitation of data presently available from this study is it possible to accurately relate pesticide residues in streams with soil characteristics, topography, cultivation, and cropping practices.

SECTION II

RECOMMENDATIONS

It is very unfortunate that this study was terminated after only year and not permitted to continue for the three-year period designated in the proposal. The criteria for a one-year program would probably have been considerably different than that of the three year agreed upon by EPA and The Ohio State University in that the collection and concentration of effort would probably have been changed in order to provide for more meaningful sampling and consequent evaluation of the situation. We learn considerably during the first year of a relatively long-range program of the adjustments in proposal design and techniques that will make subsequent procedures more adequate to meet the goals of the project.

At the present time, the data gives no basis for assessing any particular problems in the use of pesticide chemicals either in agricultural or municipal surroundings. Therefore, no recommendations are made herein to affect pesticide use practices as long as they are used in accordance with the registration, label, and necessary precautions befitting the situation.

It is recommended that the continuation of this study be reconsidered. Modifications in time and techniques of sampling should be considered in order to provide for optimum evaluation of the actual situation. This would mean more intensive sampling during the seasons when pesticides are being used with less effort during the non-use seasons. Better timing of sampling to correspond with heavy rainfall and the subsequent high river flow and also with periods of low river flow during the growing season would provide better means for evaluating the movement of pesticide residues from the point of application to the water way systems. Better techniques in the procedures for obtaining more representative water samples from large rivers should also be considered.

SECTION III

INTRODUCTION

The well known pollution of Lake Erie has caused a decrease in the desirable commercial fish and a deterioration in the water quality which grossly affects the recreation and water usage of the lake. Many sources contribute to the pollution of this body of water, causing it to be termed by some "a major cesspool problem" for the United States. Concern has been expressed at times relative to pesticide contamination associated with the river drainage systems and the contribution of agriculture to such contamination. However, the pesticide content of the streams and rivers flowing through these intensified agricultural areas of Ohio and hence into Lake Erie has never been determined. Nor have related comparisons been made between agricultural and urban sources of pesticide contamination in these areas. It thus becomes necessary to determine the sources and extent of pesticide contamination in order to provide guidelines to control and/or regulate the flow of pesticide residues via these rivers into Lake Erie. If agricultural lands are contributing significant quantities of these residues, research should provide a correlation between pesticide residues in the drainage systems, agricultural practices and soil types. Once the sources are determined and such relationships established, appropriate action might be taken to alleviate the problem. This study in Ohio would also correlate with work being done in Michigan and Wisconsin to not only provide information on pollution in Lake Erie, but also provide a picture of the Great Lakes region.

Considerable investigation has been and is being conducted in the United States concerning the monitoring of agricultural soils and river drainage systems for pesticide content. (Health Aspects of Pesticides - Abstract Bulletin 1968-71 and Pesticide Monitoring Journal 1968-71). In 1957, the the Public Health Service of the U.S. Department of Health, Education and Welfare began a surveillance system for chemical, physical, and biological water quality in relation to pollution. This monitoring program had grown to 131 sampling sites in the U.S. by 1966. From 1959 through the winter of 1962-1963, the residue levels of DDT, toxaphene, and BHC were monitored in the water emanating from an agricultural watershed in northern Alabama; samples being taken from both the untreated and treated water at a municipal purification plant located at the river confluence (Nicholson, et al , 1964). The impact of these residues on the nature and distribution of the zooplankton, bottom fauna, and fish in Flint Creek was studied (Grzenda, et al, 1964). In 1964, a monitoring system was initiated by the USDA at five locations on the lower Mississippi River Delta. In 1965, the U.S. Geological Survey initiated a limited program of pesticide monitoring on 11 streams in the Western United States (Brown & Nishioka, 1967). Also in 1965, a monitoring program for chlorinated hydrocarbon pesticides in soil and root crops was initiated in the eastern states (Seal, et al, 1967). In 1966-67, researchers from the Department of Fish and Game in California (Modin, 1969) monitored selected estuaries from northern to southern California to determine chlorinated hydrocarbon pesticide residues in oysters, mussels, shellfish, and other fish species as related to offshore exposure and to agricultural and urban areas. As reported in Volume 1, Number 1 issue of the Pesticides Monitoring Journal, June 1967, Federal Departments of Defense, Interior, Agriculture and HEW are in the process of initiating and conducting surveys of pesticide content in soil, water, tissues, and of organisms existing in such medium throughout the United States. Results of these surveys have been published in subsequent issues of the journal as the data has become available.

In the water surveys conducted under the direction of the Federal Departments indicated in the preceding paragraph, sampling sites were selected at the mouths of major streams throughout the country and in some locations in middle or upper areas of some streams. This monitoring program, however, did not include any of the northern Ohio rivers that empty into Lake Erie. The survey also does not attempt to establish the sources of pesticide pollution. Agriculture, because of its wide use of pesticides, will in all likelihood bear the brunt of public disdain as the major cause of pesticide pollution of the water resources, particularly among those who are not agriculturally oriented or unknowledgable scientifically with the problem.

Pesticide residue monitoring on some major streams in Ohio has been conducted by the Ohio Department of Health since 1966. This program has been concerned basically with water quality and consequently with trace amounts of pesticides in grab samples. No attempt was made to determine source of contamination. The Plant Protection Division of EPA as a part of the federal monitoring system has selected 312 sampling sites on cropland and non-cropland in Ohio. Data accumulated during the 4-year study (2 years results now tabulated) will associate residue with watershed as a potential stream pollution problem.

Our laboratory, The Cooperative Extension Service Pesticide Analytical Laboratory, has conducted residue analysis for the past 3 years on surface and tile drainage waters from controlled agricultural plots in a project designed to determine the role of agriculture in stream contamination. Such data will supplement that derived from the project reported herein from the past year's collection and monitoring of water, bottom sediment, and clam samples from major rivers in the Lake Erie watershed.

Programs which have been or are now underway in several states on the soil and water monitoring program are concerned principally with DDT and related chemical residues. In Massachusetts (Lyman et al, 1968) the investigation was for DDT and its metabolites in fish in all the major watersheds during 1965, 1966 and 1967. In Oregon (Marston et al, 1968) the study centered on the movement downstream from a watershed sprayed aerially with the herbicide Amitrole. In Arizona (Ware et al, 1968-1971) the study involved the movement and persistance of DDT in the soil. Other investigators such as Swoboda and Thomas, 1968; Nash and Woolson, 1968; and King and McCarty, 1968, have studied the movement of pesticides in the soil. Bailey and White, 1964;

Bailey, 1966; and Bailey, 1968 investigated the role of soil chemical and physical properties, absorption and desorption, and climate on the relationship of pesticides in soils and drainage water. Epstein and Grant, 1968, studied the chlorinated pesticide content of runoff water in Maine potato fields as affected by crop rotation. Many other studies too numerous to cite individually (Journal of Agricultural and Food Chemistry, 1965-1971; Bulletin of Environmental Contamination and Toxicology, 1966-71; Pesticide Monitoring Journal, 1968-71; and other journals) have likewise been concerned with the fate of pesticides in soil, water, and commodities. Although all these studies have direct relationship to possibilities of pesticides in the drainage from agricultural land, research is yet needed to determine the source of stream pesticide pollution in the Lake Erie watershed and relate it to the agricultural and urban cultural practices or waste disposal methods, the soil types, topography, etc.

SECTION IV

SAMPLE COLLECTION

Sites for sampling water and corresponding sediment were selected at appropriate locations representing agricultural and municipal areas along the tributaries and the main streams of the Maumee, Portage, Sandusky, Huron, and Grand Rivers in northern Ohio. (See Appendices I and II) Sites were preferentially selected to show pesticide residue runoff from intensified agricultural areas and to contrast that with pesticide levels in the streams after the influence of drainage systems of large communities or cities. Sites that would exhibit the influence of heavy industrial manufacturing, pesticide formulation, and barrel reclaiming areas were generally avoided. Sites were also selected at the mouths of the rivers as they flow into Lake Erie and around the islands near Sandusky Point.

Water samples, bottom sediment samples, and fresh water clams (where available) were collected from each site on a monthly basis or more often following periods of heavy rainfall and runoff. (See Appendix III) Sampling was done as feasible during the inclement cold weather of late December, January, and February (ice conditions on rivers and the lake generally make sampling prohibitive during this period). Water samples were obtained with a model 1200 Ekman Water Sampler and transferred to clean aluminum foil capped, one-half gallon glass milk bottles for transport to the laboratory. Approximately one gallon of water was collected at each site. Sediment samples were collected as the water sediment interface from the bottom of the river at appropriate locations across stream with a six inch model 196 Ekman Dredge. A weighted Model 196 dredge was used at locations in the river and in the lake where the bottom was deep. Sediment collections were transferred to plastic bags for transport to the laboratory and after removal of the water were transferred to large Dixie cup type covered containers. Clams were collected by hand from the natural beds located in the bottom of the streams and were transported to the laboratory in plastic bags. Flexibility in a sampling was maintained between rivers and sampling sites so that if problem areas arose they could be adequately evaluated as required and modifications made in the intensity and frequency of sampling of the particular area.

Water samples were generally extracted as received in the laboratory by the appropriate procedures outlined in Appendix V. The extracts were then stored in a -20°C freezer until analyzed by gas chromatography for residues of organochlorine insecticides such as DDT, aldrin, dieldrin, heptachlor, lindane, methoxychlor, and appropriate metabolites considered of significance in the ecosystem; for organophosphate insecticides such as parathion, malathion, diazinon and others considered of agricultural importance in the appropriate areas; and for herbicides common to Ohio agriculture including the chlorophenoxy acids and triazines. Bottom sediment samples were stored in the freezer until the time schedule permitted their extractions according to the procedures outlined in Appendix VI. Likewise the extracts were stored in the freezer until analyzed by gas chromatography. Clam samples were stored in the freezer upon arriving in the laboratory. They were not, however, analyzed for pesticides residues in this study because of the limited number of samples obtained.

SECTION V

SAMPLE PREPARATION AND ANALYSIS

Samples were prepared, extracted and pesticide residues analyzed by the procedures outlined in Appendix V and VI. Confirmation of residues was accomplished by the comparison of gas chromatography on 2 or more columns and in many cases two or more gas chromatographs, by determination of "p" values and in some cases by bromination. The following gas chromatographic conditions were utilized.

a. Organochlorine pesticide residues: (1) Barber Colman Series 5000 Gas Chromatograph equipped with a Trituim foil Electron Capture Detector and a 6 ft column of 10.4% DC-200 plus 15.1% QF-1 (mechanical mixture) on Gas Chrom Q operated at 180-190° C with detector at 210° C and injection port at 215°. Nitrogen used as carrier gas. (2) Varian 2100 Gas Chromatograph equipped with a ^{63}Ni Electron Capture detector and columns: 6 ft of 3.0% SE-30 Variport 30 and 4 ft of 5% Dexsil 300 on Gas Chrom Q operated at column temperatures of 175-190° C, detector temerature 240-245° C and injector temperature of 220° C. Nitrogen used as carrier gas. (3) Tracor Microtek 220 Gas Chromatograph equipped with a ^{63}Ni Electron Capture detector and columns: 6 ft 4.5% DC-200 plus 0.5% Epon 1001 on Anachrom ABS operated at colmun temperature 180-190° C, detector temperature 260° C and injector temperature 225° C. Nitrogen used as carrier gas.

b. Triazine herbicide residues: (1) Varian 2100 GLC equipped with alkali flame ionization detector with columns: 6 ft SE-30 on Variport 30 and 4 ft 1.0% OV-17 plus 2% OV-210 on Gas Chrom Q operated at temperatures indicated for organochlorine pesticide residue analysis. Hydrogen and Nitrogen flow rates were adjusted to provide for optimum sensitivity. (2) Barber Colman Series 5000 GLC equipped with detector and column as above for organochlorines. (3) Tracor Microtek 220 equipped with ^{63}Ni Electron Capture detector and 4 ft column of 1.0% OV-17 plus 2.0% OV-210 operated at temperatures indicated for organochlorines.

c. Organophosphates. (1) Varian 2100 equipped with AFID and columns: 6 ft SE-30 on Variport 30 and 4 ft 1.0% OV-17 plus 2.0% OV-210 on Gas Chrom Q operated as above for triazines.

d. Chlorophenoxy acid herbicides. Analyzed on all three gas chromatographs listed previously for analysis of organochlorines and utilizing all columns thus listed with the exception of the Dexsil 300.

SECTION VI

RESULTS AND DISCUSSIONS

The tabulation of analytical data from analysis of water and bottom sediment is contained in Appendix VII. Results for organochlorine insecticides, triazine herbicides, chlorophenoxy herbicides, and organophosphate insecticides are found in Table 14 through 17 respectively. The number of mussel samples collected was too few to be of significance and consequently such data is not included in the tabulation. The river flow data, indicating periods of runoff caused generally by drainage from rainfall or irrigation, as compiled by the Geological Survey for the period of time spanning the sampling is listed in Appendix IV. Soil characteristics and cropping practices associated with the general areas of sampling are shown in Appendix II.

The analytical methods used in this study were capable of measuring organochlorine pesticide concentrations as low as 1.0 part per trillion in water and 10 parts per trillion in bottom sediment and in the sub-part per billion range for other pesticides (although the sensitivity levels were established as indicated below). The gas chromatography instruments were capable of measuring as little as 15 picograms of aldrin with one-half scale recorder response. Thus extremely low concentrations of pesticide residue could be measured with accuracy. At those extremely low levels of measurement, the background for some samples sometimes became bothersome and consequently required additional analysis with other chromatographic systems (columns and instruments as indicated in Section V) in order to determine the presence or non-presence of pesticide residue. In addition "p" values were calculated in confirming residues (partitioning coefficient of the pesticide between equal volumes of hexane and acetonitrile). Whenever the resolution of the gas chromatographic peak was doubtful or reanalysis and "p" value calculation still resulted in non-evaluable results, the entry was left blank for the particular sample and pesticide residue in question. Astericks in place of numbers in Tables 14-17 indicate that the representative peaks for the residue involved were observed by two or more gas chromatographic systems but that the "p" value was slightly outside the accepted book value range and the value range determined according to our laboratory techniques. Consequently, no residue values were calculated for those particular samples and it is doubtful that any residues were present. The letter "N" in Tables 14-17 indicate that no pesticide residues were determined at the sensitivity level of approximately 1 ppt in water and 10 ppt in bottom sediment for organochlorine insecticides, and 0.1-1.0 ppb for organophosphate insecticides, 0.5-1.0 ppb for triazine herbicides, and 0.5 to 1.0 ppb for chlorophenoxy acid herbicides in water and bottom sediment respectively.

The occurrence of organochlorine pesticide residue in water and bottom sediment samples is recorded in Table 14. Some indication of residue was evident in the initial analysis but confirmatory analysis by the procedures indicated in the preceding paragraph failed to substantiate such presence. Five water samples gave indication of residue but could not be satisfactorily substantiated via the confirmatory process. Several blanks in the table of data indicate non-availability of analytical data or the uncertainity of results as indicated in the preceding paragraph.

Seventeen of the bottom sediment samples gave positive residue indication for dieldrin with 15 more possible (denoted by asterick) but not positively confirmed; 11 samples contained p,p'-DDD with 7 more possible; 2 samples contained p,p'-DDT; and 4 samples contained p,p'-DDE with 2 more possible. There was no apparent correlation in the samples for occurrence of the DDT isomers and metabolites. Concentrations of dieldrin ranged from 1.06 parts per billion to 17.6 ppb with an average for the 17 samples of 5.54 ppb. Concentration of p,p-DDD in the confirmed samples ranged from 0.7 ppb to 158.54 ppb with an average of 15.77 ppb. All except 2 samples were below 8.0 ppb. The two samples containing p,p'-DDT were at 5.1 and 16.44 ppb and the range of the 4 samples containig p,p'-DDE was 2.1 to 34.6 ppb with 3 of the samples less than 3.2 ppb. Thus the concentration of organochlorine pesticide residue showing positive in this small fraction of the total sampling was negligible and insignificant.

The occurrence of triazine herbicide residues in water and bottom sediment samples is shown in Table 15. Ten water samples and eleven bottom sediment samples gave indication of atrazine (2-Chloro-4 ethylamino-6-isopropylamino-a-triazine) residues and 4 water samples appeared to contain simazine (2-Chloro-4,6-bis(ethylamino)- s - triazine). Atrazine residues in such water samples ranged from 2.73 to 69.44 ppb with an average of 23.82 ppb and in bottom sediment from 4.47 to 95.19 ppb with an average of 43.27 ppb. Simazine concentrations in the four samples were 26.40, 29.93, 32.40, and 238.86 ppb. Some correlation of triazine residue was observed between the water and corresponding bottom sediment samples in that when residues were determined in water they were also generally found in the bottom sediment samples from the corresponding or next adjacent sampling site. The most common occurrence of triazine herbicide residues was associated with the spring cultivation season and generally with agricultural related sites. In several cases, residues were determined in the samples from the same site at each sampling period during May and June. Triazines are used quite extensively in Ohio for weed control in corn. The occurrence of minute traces of atrazine following irrigation or rainfall was also noted by Schwab et al, 1970 and 1971 in studies conducted on drained research plots at the Castalia Branch of the Ohio Agricultural Research and Development Center.

Residues of chlorophenoxy acid type herbicides were practically non-existent in the water and bottom sediment samples collected during this study (Table 16). The only exceptions were two samples; i.e. a water sample containing an apparent residue of 7.0 ppb 2,4,5-T and a bottom sediment sample with an apparent residue of 22.7 ppb dicamba (3,6-Dichloro-o-anisic acid). Initial investigations had indicated that minute concentrations of 2,4-D and dicamba might have been present in several samples but additional analysis on different chromatographic systems did not confirm such occurrence. The water sample was associated with an agricultural site on the Portage River in late June and the bottom sediment sample with a municipal site on the Huron River in mid-May. The occurrence of the herbicide residue at each of these respective sites is not explanable in that 2,4,5-T is no longer registered for agricultural nor home owner use (only for non-cropland) and dicamba would not generally be associated with municipal use. The only explanation for the latter would be an industrial spill or dumping or the disposition of material from agricultural areas of the river. In view of the fact that no indication of dicamba (or 2,4,5-T) residues were found at any other locations nor at any other sampling date casts considerable doubt on the validity of the residues indicated above.

The analytical data for organophosphate insecticide residues are tabulated in Table 17. The only valid occurrence of residue was in the bottom sediment at two sites on the Huron River from the May and June 1972 samplings. Two other occurrences, one from the Maumee River sampled in December and one from the Huron River in December are not explanable unless some waste was dumped at those times. Concentrations of residues in the six bottom sediment samples indicating diazinon (0,0-Diethyl 0-(2 isopropyl-4-methyl-6-pyrimidinyl) phosphorothioate) were very low ranging from 3.6 to 13.6 ppb. One sample from site No. 1 on the Huron River in June 1972 indicated the possible presence of 3.3 ppb of ethyl parathion (0,0-Diethyl 0-p-nitrophenyl phosphorothioate).

The results of this monitoring survey corresponds favorably with published results of similar monitoring by the Ohio Department of Health on major streams in Ohio (1966-71). One site each on the Maumee and the Sandusky Rivers were included in their sampling in which no organochlorine nor organophosphate pesticide residues were reported in 1971. Data for 1972 for comparative purposes is not yet printed.

It is at present impractical to relate any pesticide residue occurrences to particular areas or particular cultivation and cropping practices. There are no significant differences between residues attributed to agriculture versus that attributed to municipalities and industry because basically no significant occurrence of pesticide residues were found at any locations. If any relationships were attempted, it would appear that triazine (simazine) in water was associated with the residential and industrial area of Fremont on the Sandusky River, but atrazine with agricultural areas on the Huron River systems. Some corn acreage preceded Fremont upstream and sites 1 to 4 on the Huron River were associated with corn producing areas (See Appendix II). As indicated before, triazines are used for weed control in corn. The few occurrences of triazine (atrazine) in mud samples are associated generally with one particular agricultural area of the Maumee, Portage, Sandusky, and Huron Rivers and were evident during the planting and early growing season. The residue value for site 1 on the Sandusky River in November 1971 cannot be explained. The minimal occurrence of organophosphates pesticide residues reported, appears to be related with one particular section of the Huron River in which agriculture and corn production is the predominant environmental factor. Diazinon is used for insect control in corn production.

At present, it is unrealistic to associate pesticide residue occurrence in this study with soil and topographical characteristics. Comparison of the data in Appendix VII with the descriptions of corresponding sites in Appendices I and II indicates that most sites on the Maumee, Portage, Sandusky, and Huron Rivers were related to level or nearly level topography; the major exceptions being some slightly rolling topography near some of the stream depressions. Hilly topography was more noticiable in the Grand River watershed. Correlation of pesticide residue data with soil structure, drainage, etc., is not attempted at present because the residue data are not significant and soil descriptions are not available for all areas of particular interest. Any such attempted correlation would be meaningless.

The river flow data which would indicate possible periods of rainfall and consequent drainage runoff is listed in Appendix IV. In accordance with the discussion of the previous paragraph, any correlation between drainage reflected as river flow and pesticide residue is meaningless at present. The main observation made is that the optimum time for sampling as far as drainage is concerned may not have been attained, particularly during the 1972 planting and early growing season. Of course, other factors such as times of soil preparation, pesticide application, cultivation, plant growth, etc., are equally as important as is drainage and runoff in assessing the relationship of pesticide residues in the streams to the source of contamination. Also, the flow data of Appendix IV raises the consideration of more practical procedures in sampling water from large rivers where the volume of water flowing creates great dilution factors. Because of such phenomenon, drainage waters from residential and industrial areas near the mouth of a large river may be so diluted that the analytical procedures and instrumentation used in this study could be incapable of measuring positive values. Any consequent comparison between municipal sources and agricultural sources of pesticide pollution may be invalid. On the other hand, measurable concentrations of pesticide residues in the water at the mouths or large areas of the river multiplied by the flow rate of the river could result in an interpretation of residue content that is astronomically high and thus also invalid.

It is advisable that this project be reinstituted for the remaining 2 years of the three-year proposal. Some revisions perhaps should be made in sampling in order to obtain samples at the optimum times and by improved techniques. Residue data from three years of sampling would appear to be much more valid than that from only one year and could likely also be more comprehensively evaluated, if the time of sampling were more selective in schedule. This would permit more intense sampling during the cultivation and planting season and during periods of high runoff following rainfall as well as at periods of low river flow.

SECTION VII

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APPENDIX I

SAMPLING SITES

Table 1 Sampling Sites

River	Site	Description	Latitude	Longitude
Maumee	1	Rt 49 in Antwerp	41° 12'	84° 44'
	2	Auglaize River, Rt 66 Oakwood	41° 06'	84° 22'
	3	Tiffin River, Steven Rd off Rt 18	41° 19'	84° 24'
	4	Rt 109 Bridge between Napoleon and Grand Rapids	41° 25'	84° 00'
	5	Interstate 280 bridge in Toledo. Before sewage treatment disposal	41° 39'	83° 30'
	6	At buoy #48 Maumee Bay. After sewage treatment disposal	41° 41'	83° 28'
	7	At buoy #38 Maumee Bay	41° 43'	83° 25'
Portage	1	Rt 199 near Scotch Ridge	41° 24'	83° 31'
	2	Rt 6 near New Rochester	41° 22'	83° 30'
	3	Bradner Rd east of Pimberville	41° 25'	83° 26'
	4	Rt 20 in Woodville	41° 27'	83° 22'
	5	Rt 19 in Oak Harbor. Before sewage treatment plant	41° 30'	83° 08'
	6	Rt 163 drawbridge in Port Clinton	41° 31'	82° 58'
	7	200 yds into Lake Erie	41° 32'	82° 57'
Sandusky	1	Rt 602 off Rt 96 N.E. of Bucyrus	40° 50'	82° 51'
	2	Rt 231 1/2 mi north of Wyandot	40° 44'	83° 08'
	3	Rt 103 1/4 mi east of Rt 53 at Tymocktee	40° 57'	83° 15'
	4	1/4 mi east of Rt 53 Fort Seneca	41° 12'	83° 10'
	5	Rt 20 bridge in Fremont	41° 22'	83° 06'
	6	Between buoys #134 #14 at mouth	41° 27'	83° 00'
	7	From bay bridge	41° 28'	82° 50'
Huron	1	Rt 162 between Rts 61 and 99	41° 08'	82° 40'
	2	Rt 61 at Peru	41° 10'	82° 38'
	3	Off Rt 61 on Snyder Rd west of Peru	41° 10'	82° 43'
	4	Fries Landing off Rt 13 north of Milan	41° 20'	82° 34'
	5	Rt 2-6 bridge in Huron	41° 23'	82° 34'
	6	Pier into Lake Erie at mouth	41° 24'	82° 33'

Grand	1	Rt 88 off Rt 534 in Farmington	41° 23'	80° 57'
	2	Footville-Richmond Rd west of Rock Creek	41° 40'	80° 53'
	3	Sweetzer Rd off Rt 45	41° 42'	80° 52'
	4	Sexton Rd off Rt 307	40° 45'	80° 54'
	5	Harpfield Rd covered bridge	41° 45'	80° 57'
	6	Madison Ave off Rt 84	41° 44'	81° 16'
	7	Richmond Rd in Painesville	41° 44'	81° 16'
Lake Erie	1	North and south of Put-in Bay and Stone Laboratory on South Bass Island		
	2	Other locations at mouths of rivers, etc. as boat facilities are available in cooperation with Dr. Herdendorf of O.S.U.		

APPENDIX II

SOIL CHARACTERISTICS AND CROPPING AT SAMPLING SITES

Table 2 Soil Characteristics and Cropping at Sampling Sites

River	Site No.	Description of Soil* and Terrain Characteristics	Major Crops in Area 1971	Major Crops in Area 1972
Maumee	1	Paulding-Roselms Assn. Clay, Hoytville-Nappanee Assn. Clay; Latty-Nappanee Assn Clay. Level to nearly level	Corn primarily	Corn, soybeans, wheat
	2	Paulding-Roselms Assn. Clay. Level to nearly level	Corn primarily	Corn, soybeans, wheat, oats, clover, alfalfa
	3	Hoytville-Napanee Assn. Clay. Level to nearly level	Corn, tomatoes primarily	Corn, soybeans, wheat
	4	Toledo-Fulton-Lenawel Assn. Clay; Millgrove-Mermill-Haskins Assn. Loam; Hoytville-Napanee Assn. Clay; Colwood-Kibbie Assn Loam; Granby-Ottokee-Tedrow Assn , sand. Level to gently sloping	Corn primarily	Corn, soybeans, wheat, clover, sugar beets, diverted acerage.
	5	Inside city limits of Toledo-prior to sewage disposal site	Residential and Industrial	Residential and Industrial
	6 & 7	In Maumee Bay	Resdential and Industrial	Resdential and Industrial
Portage	1	Ottokee-Granby-Seward-Remer-Wauseon Assn, Sandy loam; Hoytville Assn. Clay. Level to nearly level	Corn, tomatoes	Corn, Wheat
	2	Soil characteristics same as site 1	Corn, tomatoes, grains	Corn, soybeans, grains
	3	Soil characteristics same as site 1	Corn, soybeans grains	Corn, soybeans grains
	4	Hoytville Assn Clay; Millsdale-Randolph-Romero Assn. Level to nearly level	Industrial & residential, corn primarily	Industrial and residential, corn, soybeans, wheat sugar beets.
	5	Soil characteristics same as site 4 plus Haskins-Haney-Belmore Assn Sandy. Level to sloping	Residential and Industrial	Residential and Industrial

	6 & 7	Bay and Lake at Port Clinton	Residential & Industrial	Residential & Industrial
Sandusky	1	Soils map not available. Level to gently sloping and rolling	Corn, soybeans	Corn, soybeans wheat
	2	Blount-Peruams Assn, clay loam; Morley Blount Assn, clay loam. Nearly level to gently sloping and rolling	Corn, soybeans	Wheat, pasture corn, soybeans
	3	Generally same as site 2	Corn, soybeans	Wheat, corn, soybeans
	4	Haskins-Haney-Belmore Assn. Sandy; Eel, Shoal-Sloan-Genesee Assn. Salty. Nearly level to sloping	Wheat, corn alfalfa	Sugar beets, oats row crops
	5	Generally same as site 4. No soils map available	Industrial, residential	Industrial, residential (corn, wheat sugar beets, row crops prior to Fremont)
	6 & 7	In bay and lake	Industrial and residential	Residential and Industrial
Huron	1	No soils map available-probably Blount-Pewamo Assn, clay loam nearly flat to sloping and rolling	Corn, general farming	Wheat, soybeans corn, alfalfa, pasture, general farming
	2	Same as site 1	Oats, corn	Wheat, corn
	3	Same as site 1	Corn primarily	Wheat, corn
	4	No soils map available	Corn	Corn
	5 & 6	At bay and lake at Huron	Industrial & Residential	Industrial & Residential
Grand	1	Fitchville-Mahoning-Lobdell Assn. Loam. Nearly level	Some corn	Pasture, some corn diverted acreage
	2	Caneadea-Candice Assn; Griggs-Frenchtown Assn, silty loam and clay. Level to sloping to steep sloping	Corn, livestock	Corn, livestock, wheat, oats, alfalfa

Appendix II (Continued)

River	Site No.	Description of Soil* and Terrain Characteristics	Major Crops in Area 1971	 1972
Grand (contd)	3	Soil characteristics same as site 2	Corn, livestock	Corn, livestock pasture
	4	Griggs-Frenchtown Assn; Caneadea-Candice Assn; Silty clay and loam. Level to sloping to steep sloping	Some Corn	
	5	Griggs-Frenchtown Assn; Griggs-Pierpont Assn; silty clay and silty loam. Level to moderately steep sloping.	Corn, general farming, grapes	Grapes, corn, general farming
	6	Chagrin-Lobdell Assn; Chila; Mahoning-Trumbull Assn; Ellsworth-Mahoning Assn.; silt loam and clay loam. Sloping to near level to flood plain.	Grapes, Corn, Nursery stock	Grapes, corn, nursery stock
	7	Chagrin-Lobdell Assn; Caneadea-Painesville Assn. Silt loam and sandy loam. Flood plains	Industrial and Residential	Industrial Residential

* Soil characteristic maps were not available for all counties involved. In some cases, soil characteristics are assumed to be similar to that of adjacent counties.

APPENDIX III

SAMPLE COLLECTION

Table 3 - Sample Collection

River	Site	Date 1971	Date 1972	Samples Collected Water	Samples Collected Mud	Samples Collected Clam
Maumee	1	9/20-21;10/27;12/3	3/24;4/18;5/17;6/15;6/28	xxxxxxxx	xxx[ii]-xx	x--[ak]
	2	" " "	" " " " "	xxxxxxxx	x--x[i]--x	
	3	" " "	" " " " "	xxxxxxxx	xxxxxxxx	
	4	" " "	" " " " "	xxxxxxxx	xxxxxxxx	
	5	9/27; 11/24	6/8 - -	xx---x--	xx---x--	
	6	" "	5/1 " - -	xxxx	x[b]xx	
	7	" "	- - -	xx	xx	
Portage	1	9/16-17;10/26;12/2	3/24;4/18;5/17;6/15;6/28	xxxxxxxx	xxxxxxxx	
	2	" " "	" " " " "	xxxxxxxx	xxxx[j]-xx	xx--k--x
	3	" " "	" " " " "	xxxxxxxx	xxxxxxxx	-------x
	4	" " "	" " " " "	xxxx[j]xxx	-xxx[j]-xx	
	5	" " "	" " " " "	xxxxxxxx	xxxxxxxx	x---k
	6	" " 12/1	3/29;4/19;6/8 - -	xxxxxx	x-xxxx	
	7	9/27;12/2 (too rough)	4/19 " - -	x[c]xx	x[c]-x	
Sandusky	1	10/4;11/8;12/14	3/20;4/17;4/17;6/14;6/27	xxxxxxxx	xxxxxxxx	
	2	" " "	" " " " "	xxxxxxxx	xxxxxxxx	
	3	" " "	" " " " "	xxxxxxxx	xxxxxxxx	xx-d- xx
	4	" " "	" " " " "	xxxxxxxx	xxxxxxxx	xx-d-k-x
	5	" " "	" " " " "	xxxxxxxx		
	6	9/27		x	x	
	7	11/8		x		
Huron	1	9/30;11/8;12/14	3/20;4/17;5/17;6/14;6/27	xxxxxxxx	xxxxxxxx	
	2	" " "	" " " " "	xxxxxxxx	xxxx[j]-xx	
	3	" " "	" " " " "	xxxxxxxx	xxxxxxxx	
	4	" " "	" " " " "	xxxxxxxx	xxxxxxxx	
	5	" " "	" " " " "	-xx[j]xx	xxx[j]x	
	6	" "	" " " " "	xxxxxxx	xxxxxxx	

Grand	1	8/23;9/23-24;11/4;12/13	3/20;4/27;5/18;6/17;6/30	xxxxxxxxx	xxxxxxxxx	x---e kxx-
	2	" " " "	" " " " "	xxxxxxxxx	xxxxxxxxx	xx--f k
	3	" " " "	" " " " "	x---g--	x---g--	g k
	4	" " " "	" " " " "	xxxx--	xx -	xx--f k
	5	" " " "	" " " " "	xx--xxxxx	-xxxxxxxx	xx--f k
	6	" " " "	" " " " "	xxxxxxxxx	-xx-h--	xx--h k
	7	" " " "	" " " " "	-xxxxxxxx	---i--xxx	i
Lake Erie	Some samples have been collected from Put-In-Bay and other areas of Lake Erie but are limited in numbers and presently located in other laboratories. We will have access to such samples when we can schedule the analyses.					

Notes:

a. Clams not found on 1/27; too cold to get in water on 12/3.

b. Boat not available on date of sampling. Arrangements made with another department at O.S.U. on boat availability for Lake Erie and bay areas for cooperative sample collection.

c. Lake Erie too rough for boating although boat available for sampling.

d. Too cold to get into water to dig clams.

e. No clams found 9/23-24; water too cold to dig clams 11/4 and 12/13.

f. Water too cold to dig clams 11/4 and 12/13.

g. No clams found at site. Site abandoned because of close proximity to adjacent site.

h. Water too cold to dig clams 11/4 and 12/13; river flow too great to sample mud and clams 12/13.

i. Industrial site - no mud or clams available.

j. Water flow and height too great to sample mud. Couldn't get to sites for water sample.

k. Water too high and cold to dig clams in March, April of 1972.

Key: x sample collected on date indicated
- no sample collected for reasons given above in notes or for other reasons including inaccessibility at time of sample. Blank spaces with no markings indicate that the particular type sample is not available at the site selected.

APPENDIX IV

RIVER FLOW DATA: AUG 1971 - JULY 1972

Table 4

04186500 Auglaize River near Fort Jennings, Ohio

LOCATION.--Lat 40°56'55", long 84°15'58", in SE 1/4 sec. 15, T.1S., R5E., Putnam County, on left bank 200 ft upstream from bridge on U.S. Highway 224, 3.5 miles northeast of Fort Jennings, 6 miles upstream from Ottawa River, and 7.3 miles downstream from Jennings Creek.

DRAINAGE AREA.--332 sq mi.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR AUGUST 1971 TO JUNE 1972

Day	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
1	54	23	51	27	70	1,320	130	97	228	193	432
2	46	24	51	27	61	578	120	1,330	188	181	306
3	40	41	42	27	45	482	110	2,780	163	169	200
4	37	45	38	24	46	350	100	2,190	168	150	155
5	33	58	35	21	43	300	92	668	198	132	121
6	32	72	34	20	48	260	84	380	197	119	102
7	30	259	34	21	493	230	80	279	1,100	107	94
8	28	200	31	20	1,610	210	74	224	3,370	91	80
9	27	87	36	22	1,030	220	70	185	3,540	248	76
10	27	49	43	24	491	854	68	167	1,410	1,280	77
11	36	35	38	23	463	1,020	66	145	830	1,270	63
12	40	27	37	22	493	543	64	136	534	454	57
13	42	25	35	24	265	366	62	450	1,770	292	108
14	34	24	39	24	244	272	66	1,290	4,270	271	95
15	29	24	39	24	1,550	210	84	1,290	3,860	685	110
16	25	24	45	25	2,080	190	120	752	1,120	1,290	143
17	24	23	49	25	1,200	170	170	518	1,840	740	102
18	24	22	41	25	508	160	180	382	2,180	400	80
19	23	22	38	25	311	170	140	274	881	277	64
20	24	29	35	27	238	200	110	217	2,220	213	58
21	27	254	32	25	218	220	94	199	5,350	178	285

22	26	232	35	24	235	231	82	196	5,810	158	534
23	26	117	45	22	216	325	70	204	5,000	137	344
24	27	60	58	24	206	384	62	194	3,110	120	204
25	25	43	67	24	194	361	58	166	962	106	154
26	22	39	70	24	168	325	54	148	522	94	122
27	21	318	56	27	138	260	52	142	377	78	100
28	21	371	47	32	144	230	50	162	290	72	82
29	22	159	41	37	137	200	52	276	238	68	79
30	21	75	34	51	303	170	------	304	209	114	334
31	21	------	27	------	1,660	150	------	295	------	370	------
TOTAL	914	2,781	1,303	767	14,908	10,961	2,564	16,040	51,935	10,057	4,761
MEAN	29.5	92.7	42.0	25.6	481	354	88.4	517	1,731	324	159
MAX	54	371	70	51	2,080	1,320	180	2,780	5,810	1,290	534
MIN	21	22	27	20	43	150	50	97	163	68	57

Cal yr 1971	Total 86,723	Mean 238	Max 3,280	Min 15
Wtr yr 1972	Total 123,677	Mean 338	Max 5,810	Min 20

Table 5

04191500 Auglaize River near Defiance, Ohio

LOCATION.-- Lat 41°14'15", long 84°23'57", in NE 1/4 sec. 9, T.3N., R.4E., Defiance County on right bank 125 ft downstream from dam of Toledo Edison Co., 0.2 mile upstream from Jackson ditch, and 3 miles south of Defiance.

DRAINAGE AREA.--2,318 sq mi.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR AUGUST 1971 TO JUNE 1972

Day	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
1	237	69	300	31	161	6,200	478	384	1,190	1,240	3,790
2	204	124	225	42	201	3,650	412	5,280	1,010	1,150	2,370
3	160	139	195	45	208	2,340	385	11,100	813	1,050	1,430
4	146	166	2,000	52	186	1,790	358	11,500	804	932	1,150
5	138	203	184	74	180	1,370	323	6,310	1,040	804	1,210
6	123	265	21	78	188	935	312	2,600	1,300	704	951
7	115	358	22	77	330	825	276	2,080	2,780	576	746
8	107	686	24	70	2,700	795	247	1,560	11,000	551	614
9	104	572	24	80	5,170	792	223	1,090	12,000	738	505
10	115	370	24	92	3,390	2,000	199	760	9,670	4,370	660
11	107	240	98	74	2,320	4,570	185	696	4,740	5,840	790
12	123	171	176	85	1,880	3,740	177	641	4,610	3,700	668
13	160	141	161	78	618	2,450	186	4,470	7,400	3,690	517
14	150	121	144	88	284	1,610	224	10,500	11,400	2,460	565
15	137	95	137	85	3,650	828	373	11,400	12,700	3,090	648
16	128	85	134	82	7,150	597	597	11,100	8,260	3,270	689
17	108	83	133	84	6,570	528	813	8,120	7,420	5,080	820
18	96	77	130	95	3,340	530	853	5,350	10,300	3,740	841
19	95	78	128	101	2,200	601	713	3,420	7,090	2,360	673
20	85	117	127	95	1,590	823	520	1,250	6,980	1,560	520
21	80	181	123	58	1.190	992	418	1,340	14,600	1,130	464
22	80	537	81	72	350	1,050	381	1,310	23,500	994	1,030

23	63	517	27	78	29	1,360	342	1,280	25,800	834	1,150
24	73	366	27	82	275	1,780	290	1,210	23,500	682	786
25	70	255	28	86	492	2,130	267	1,040	14,000	585	577
26	65	213	30	79	497	1,400	267	838	6,240	524	471
27	58	196	30	93	497	1,150	244	722	3,750	467	398
28	60	523	30	83	453	995	240	686	2,410	411	345
29	73	614	30	109	456	869	256	790	1,700	374	325
30	71	425	31	137	898	699	------	949	1,370	474	1,250
31	60	------	31	------	4,370	555	------	1,150	------	2,080	------
TOTAL	3,391	7,987	4,855	2,385	51,823	49,954	10,559	110,926	239,377	55,460	26,953
MEAN	109	266	157	79.5	1,672	1,611	364	3,578	7,979	1,789	898
MAX	237	686	2,000	137	7,150	6,200	853	11,500	25,800	5,840	3,790
MIN	58	69	21	31	29	528	177	384	804	374	325

Cal Yr 1971 Total 462,730 Mean 1,268 Max 13,500 Min 21
Wtr Yr 1972 Total 706,163 Mean 1,929 Max 25,800 Min 21

Table 6

04192500 Maumee River near Defiance, Ohio

LOCATION.--Lat 41°17'31", long 84°16'52", in NW 1/4 sec. 22, T.4N.,R.5E, Defiance County, on left bank 40 ft upstream from Independance Dam, 4 miles downstream from Auglaize River, and 4.5 miles east of Defiance.

DRAINAGE AREA.--5,545 sq mi

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR AUGUST 1971 TO JUNE 1972

Day	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
1	470	169	1,080	415	388	12,800	1,400	1,060	5,090	5,050	6,540
2	430	276	865	385	476	10,100	1,300	7,020	4,200	5,530	5,890
3	380	307	750	330	449	7,160	1,200	13,800	3,480	4,300	4,040
4	350	310	2,380	323	421	5,920	1,100	16,900	3,460	3,660	2,810
5	330	439	1,430	338	437	5,270	950	11,800	4,240	3,550	2,830
6	300	504	629	339	454	4,060	820	7,020	4,560	3,370	2,350
7	280	534	326	322	705	3,400	740	4,980	5,600	2,980	1,860
8	260	840	293	296	3,220	2,610	680	4,580	16,600	2,640	1,570
9	240	947	314	311	8,850	2,870	620	3,750	20,000	2,710	1,260
10	220	762	291	458	8,380	4,250	580	2,730	17,900	6,420	1,350
11	260	583	378	332	7,730	7,790	540	2,120	13,800	9,560	2,040
12	308	446	440	285	6,940	7,320	520	1,830	11,400	6,990	1,900
13	422	367	401	283	4,740	5,400	500	7,380	14,100	6,190	1,290
14	363	344	397	306	3,130	3,910	520	17,600	20,800	4,940	1,110
15	324	318	392	286	8,540	2,400	890	21,500	23,000	6,320	1,570
16	315	291	391	275	15,500	1,500	1,230	21,200	20,100	8,070	3,780
17	292	275	388	283	15,100	1,260	1,560	19,000	22,400	9,480	3,780
18	252	286	374	284	11,200	1,470	1,800	16,000	24,400	7,580	2,500
19	244	275	360	304	7,680	1,810	1,710	10,000	21,000	5,600	1,740
20	220	374	347	303	5,450	2,260	1,420	8,200	18,900	4,400	1,320
21	217	383	333	255	4,360	2,600	1,160	7,000	25,300	3,640	1,100
22	229	914	369	248	3,000	3,000	1,180	7,000	36,400	3,160	1,490

23	214	862	318	259	1,860	4,320	1,110	7,200	40,700	2,600	1,830
24	195	603	624	277	1,700	5,400	1,010	6,600	39,400	2,200	1,450
25	225	481	988	273	1,750	6,400	775	5,920	31,000	1,790	1,160
26	324	481	1,090	255	1,660	5.200	798	5,120	22,000	1,530	986
27	233	493	782	308	1,570	3,800	735	4,380	15,200	1,400	848
28	207	823	607	283	1,470	3,000	695	3,970	10,600	1,250	822
29	213	1,780	504	313	1,460	2,400	735	3,590	6,820	1,100	834
30	185	1,540	437	382	3,040	1,990	------	4,240	4,810	1,230	1,360
31	165	------	444	------	9,190	1,600	------	5,540	-------	3,160	------
TOTAL	8,667	17,007	18,722	9,311	140,850	133,270	28,278	259,030	507,260	132,400	63,410
MEAN	280	567	604	310	4,544	4,299	975	8,356	16,910	4.271	2,114
MAX	470	1,780	2,380	458	15,500	12,800	1,800	21,500	40,700	9,560	6,540
MIN	165	169	291	248	388	1,260	500	1,060	3,460	1,100	822

Cal Yr 1971 Total 1,142,259 Mean 3,129 Max 31,400 Min 165
Wtr Yr 1972 Total 1,628,853 Mean 4,450 Max 40,700 Min 248

Table 7

041850000 Tiffin River at Stryker, Ohio

LOCATION.--Lat 41°30'17", long 84°25'49", in SW 1/4 sec. 5, T. 6N., R.4E., Williams County, on right bank 0.5 mile downstream from bridge on State Highway 191 at west edge of Stryker, 0.6 mile upstream from Penn Central bridge, and 1.6 miles downstream from Leatherwood Creek.

DRAINAGE AREA.--410 sq mi.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR AUGUST 1971 TO JUNE 1972

Day	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
1	21	7.0	19	28	42	594	120	155	358	304	265
2	20	10	16	29	33	601	110	305	332	406	209
3	18	13	16	30	32	490	100	439	303	582	180
4	19	19	17	31	33	369	96	428	310	670	275
5	21	18	16	29	35	275	92	348	364	609	257
6	19	23	19	28	29	227	86	269	381	452	182
7	16	18	19	27	58	194	82	214	356	353	140
8	15	18	23	28	84	195	78	211	318	318	113
9	14	17	24	28	88	198	74	181	301	334	97
10	13	15	24	29	96	217	72	152	301	379	87
11	17	13	25	31	132	244	70	147	295	395	76
12	18	11	23	30	163	238	72	157	274	349	68
13	16	11	23	29	143	222	76	338	288	295	71
14	14	11	24	25	112	202	84	800	354	269	73
15	13	11	23	24	143	150	96	1,090	426	279	155
16	12	9.8	22	23	205	110	120	1,540	693	328	332
17	12	9.0	21	23	222	94	171	1,760	1,160	361	244
18	11	8.5	20	24	181	86	181	1,730	1,360	341	151
19	11	8.0	20	29	133	92	150	1,500	1,570	290	109
20	10	16	21	30	107	130	130	1,190	1,470	240	90
21	9.3	26	22	33	97	194	120	890	1,320	205	89
22	9.2	27	28	31	87	252	110	842	1,510	180	122
23	10	20	37	29	74	410	110	887	1,590	160	111

24	9.9	16	45	26	79	469	100	989	1,470	142	102
25	9.5	15	51	28	74	475	94	1,000	1,240	127	87
26	9.0	14	53	29	71	402	90	792	941	113	80
27	8.0	16	47	31	70	318	86	567	646	102	99
28	8.0	20	37	33	76	250	88	425	439	92	106
29	8.5	22	34	38	79	206	98	372	349	86	102
30	8.5	21	31	41	176	171	------	371	302	93	104
31	7.5	------	29	------	435	140	------	376	------	196	------
TOTAL	407.4	463.3	829	874	3,399	8,215	2,956	20,465	21,021	9,050	4,176
MEAN	13.1	15.4	26.7	29.1	110	265	102	660	701	292	139
MAX	21	27	53	41	435	601	181	1,760	1,590	670	332
MIN	7.5	7.0	16	23	32	86	70	147	274	86	68
CFSM	.03	.04	.07	.07	.27	.65	.25	1.61	1.71	.71	.34
IN.	.04	.04	.08	.08	.31	.75	.27	1.86	1.91	.82	.38

Cal Yr 1971 Total 78,736.7 Mean 216 Max 2,910 Min 7.0 CFSM .53 IN 7.14
Wtr Yr 1972 Total 78,279.0 Mean 214 Max 1,760 Min 16 CFSM .52 IN 7.10

Table 8

04192400 Maumee River at Waterville, Ohio

LOCATION:--Lat 41°30'00", long 83°42'46", Lucas County, on downstream side of second pier from left end of bridge on State Highway 64 at Waterville, 3 miles downstream from Tontogany Creek, and 21.1 miles above the mouth.

DRAINAGE AREA.-- 6,330 sq mi.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR AUGUST 1971 TO JUNE 1972

Day	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
1	560	220	1,500	405	450	14,300	1,700	880	5,680	5,360	5,500
2	560	340	1,050	628	400	13,200	1,500	6,360	4,940	6,200	6,840
3	500	360	848	394	500	9,420	1,400	15,500	4,160	5,400	5,680
4	420	390	884	317	460	7,440	1,300	19,500	4,190	4,420	4,190
5	390	520	2,880	259	450	6,440	1,200	14,800	4,700	4,060	3,570
6	370	580	1,130	383	520	5,820	1,100	9,550	5,120	4,000	3,160
7	330	660	614	443	800	5,220	1,000	5,960	5,120	3,270	2,490
8	300	860	306	250	2,230	4,060	900	5,150	11,400	3,180	2.050
9	270	1,000	350	268	7,640	3,480	800	4,640	20,800	3,570	1,570
10	240	1,200	339	455	10,800	4,670	740	3,940	19,700	5,080	1,320
11	330	840	328	418	9,280	7,800	660	3,040	16,500	9,510	1,660
12	400	660	339	405	8,380	9,150	620	2,330	11,800	8,520	2,130
13	520	540	405	317	6,920	6,760	580	5,190	12,500	6,170	1,930
14	440	420	443	295	4,260	5,000	640	19,200	19,100	5,850	1,500
15	410	380	383	430	7,000	3,000	860	24,600	24,500	5,780	1,500
16	380	360	394	350	16,300	2,300	1,500	24,900	23,000	8,740	3,020
17	350	340	394	328	18,200	1,800	2,000	22,500	25,700	9,060	4,800
18	310	330	443	383	14,100	1,600	2,100	18,700	26,100	8,520	3,630
19	280	380	405	558	9,960	1,900	1,800	15,000	23,400	6,320	2,490
20	250	440	394	394	7,080	2,400	1,600	11,700	19,700	5,120	1,850
21	260	500	383	360	5,610	3,600	1,400	8,430	23,300	4,320	1,800
22	270	600	493	214	4,540	3,690	1,300	8,520	38,400	3,510	1,590

23	250	1,000	505	232	3,020	5,220	1,200	8,290	46,900	3,180	2,030
24	230	700	443	290	2,200	7,000	1,100	7,760	44,400	2,570	1,950
25	300	560	902	320	2,000	7,880	1,000	6,480	36,200	2,100	1,500
26	370	500	1,390	370	1,900	6,000	900	5,820	25,500	1,730	1,230
27	400	600	1,170	370	1,800	4,500	820	5,150	18,000	1,520	1,070
28	300	620	866	350	1,700	3,400	760	4,480	12,400	1,430	920
29	230	1,100	642	340	1,700	2,600	800	4,290	8,250	1,250	1,050
30	200	1,900	544	380	2,100	2,200	----	4,450	5,990	1,280	2,200
31	170	----	544	-----	7,320	1,900	----	5,330	-----	2,000	-----
TOTAL	10,590	18,900	21,711	10,906	159,620	163,750	33,280	302,440	547,450	143,020	76,220
MEAN	342	630	700	364	5,149	5,282	1,148	9,756	18,250	4,614	2,541
MAX	560	1,900	2,800	628	18,200	14,300	2,100	24,900	46,900	9,510	6,840
MIN	170	220	306	214	400	1,600	580	880	4,160	1,250	920
CFSM	.05	.10	.11	.06	.81	.83	.18	1.54	2.88	.73	.40
IN.	.06	.11	.13	.06	.94	.96	.20	1.78	3.22	.84	.45

Cal Yr 1971 Total 1,311,775 Mean 3,594 Max 38,900 Min 170 CFSM .57 In 7.71
Wtr Yr 1972 Total 1,853,731 Mean 5,065 Max 46,900 Min 214 CFSM .80 In 10.89

Table 9

04195500 Portage River at Woodville, Ohio

LOCATION.--Lat 41°26'58", long 83°21'41", in sec. 28, T.7N., R.13E., Sandusky County, on left bank of bridge on U.S. Highway 20 in Woodville, 600 ft downstream from unnamed right bank tributary, and 10.3 miles upstream from Sugar Creek.

DRAINAGE AREA.--428 sq mi.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR AUGUST 1971 TO JUNE 1972

Day	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
1	30	6.4	38	24	52	930	90	70	136	185	422
2	22	7.9	28	22	42	522	82	1,610	127	276	276
3	16	11	23	19	39	422	82	2,860	114	294	208
4	12	15	17	19	29	333	94	1,030	138	208	321
5	11	13	16	20	25	240	90	490	267	152	240
6	11	13	14	19	32	150	86	253	288	125	156
7	10	14	15	16	190	160	82	200	264	112	120
8	8.6	14	17	15	534	170	78	160	250	114	101
9	7.7	14	22	16	373	140	74	130	288	785	81
10	6.6	13	42	16	245	910	70	120	345	1,700	70
11	9.3	13	43	17	245	975	66	120	359	765	60
12	26	11	30	18	195	598	64	130	282	426	55
13	30	12	22	20	138	419	62	935	288	309	55
14	18	12	19	20	110	288	90	3,160	397	297	144
15	13	10	17	17	582	160	120	2,720	359	720	138
16	10	8.8	18	17	1,070	140	240	2,130	498	985	115
17	7.8	10	18	15	594	120	200	1,730	1,670	586	102
18	7.1	11	17	11	315	110	160	1,080	1,140	380	81
19	7.4	10	15	12	190	110	130	690	634	267	60
20	8.6	22	15	12	152	120	100	482	638	208	51
21	14	51	14	13	138	160	90	408	1,660	171	122
22	25	73	17	14	117	230	80	429	2,370	146	127

23	16	40	24	13	93	360	70	482	3,660	120	90
24	17	25	30	11	90	400	60	345	1,850	99	73
25	11	19	33	10	84	538	52	258	820	85	61
26	9.0	17	29	10	80	401	46	228	514	73	54
27	8.1	160	28	14	74	320	44	200	366	63	59
28	8.6	225	26	18	70	240	42	183	276	55	54
29	11	100	26	33	66	160	54	165	225	48	176
30	9.1	54	25	46	486	130	------	167	195	55	660
31	7.5	------	25	------	1,700	100	------	158	------	140	------
TOTAL	408.4	1,004.1	723	527	8,150	10,056	2,598	23,123	20,318	9,949	4,332
MEAN	13.2	33.5	23.3	17.6	263	324	89.6	746	677	321	144
MAX	30	225	43	46	1,700	975	240	3,160	3,660	1,700	660
MIN	6.6	6.4	14	10	25	100	42	70	114	48	51
(≠)	5.26	5.98	5.37	4.71	4.24	4.78	4.82	4.38	4.78	5.16	4.54
MEAN ≠	7.94	27.5	17.9	12.9	259	319	84.8	742	672	316	139
CFSM ≠	.02	.06	.04	.03	.61	.75	.20	1.73	1.57	.74	.32
IN ≠	.02	.07	.05	.03	.70	.86	.21	2.00	1.75	.85	.36

Table 10

04197000 Sandusky River near Mexico, Ohio

LOCATION.--Lat 41°02'39", long 83°11'42", in sec. 13, T.1N., R.14E., Seneca County, on right bank at downstream side of county road bridge, 4.1 miles upstream from Honey Creek, 4.2 miles north of Mexico, 4.9 miles south of Tiffin, and 8.3 miles downstream from Mile Run.

DRAINAGE AREA.--774 sq mi.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR AUGUST 1971 TO JUNE 1972

Day	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
1	52	13	18	26	49	1,460	110	140	274	396	341
2	42	13	17	26	47	1,010	90	1,790	248	351	315
3	37	13	17	24	50	567	120	3,790	232	314	276
4	35	14	15	24	47	380	150	3,310	235	279	223
5	32	14	14	25	47	300	160	2,150	238	249	177
6	29	14	14	26	53	260	140	1,200	224	221	148
7	26	14	14	29	74	240	130	700	523	196	129
8	24	13	14	31	108	280	120	480	2,100	190	116
9	21	15	19	31	145	296	120	400	2,060	1,660	109
10	20	23	21	30	165	522	110	360	1,830	3,650	105
11	24	32	21	29	139	1,340	110	340	1,280	3,290	97
112	25	25	32	29	108	1,290	100	310	912	2,520	88
13	22	22	41	29	86	803	100	1,150	1,790	1,170	108
14	20	17	34	29	83	539	110	4,150	3,240	761	232
15	22	15	41	31	122	340	180	4,480	2,980	2,530	387
16	20	15	36	31	309	260	380	3,720	2,590	4,050	394
17	18	14	29	30	494	200	650	3,110	3,680	3,690	311
18	18	13	24	31	443	170	911	2,520	3,690	2,730	228
19	18	13	22	34	285	150	560	1,530	2,820	1,350	184
20	16	17	21	34	182	140	450	957	3,670	756	143
21	13	21	22	36	139	190	320	696	6,260	539	120
22	13	27	26	36	115	220	240	1,100	9,290	416	108

23	12	36	31	42	103	517	190	2,380	11,200	335	102
24	11	32	38	40	98	610	150	2,070	7,910	277	99
25	11	24	32	36	91	500	130	1,080	4,630	233	91
26	12	24	28	33	83	340	110	731	1,810	199	88
27	14	25	30	33	78	280	90	571	1,040	171	85
28	17	22	31	36	75	240	82	471	742	154	80
29	15	22	28	43	74	200	76	403	572	139	165
30	14	20	28	43	93	160	-----	360	461	170	395
31	13	-----	29	----	624	130	-----	312	------	352	-----
TOTAL	666	582	787	957	4,609	13,934	6,189	46,761	78,531	33,338	5,444
MEAN	21.5	19.4	25.4	31.9	149	449	213	1,508	2,619	1,075	181
MAX	52	36	41	43	624	1,460	911	4,480	11,200	4,050	395
MIN	11	13	14	24	47	130	76	140	224	139	80
CFSM	.03	.03	.03	.04	.19	.58	.28	1.95	3.38	1.39	.23
IN.	.03	.03	.04	.05	.22	.67	.30	2.25	3.77	1.60	.26

Cal Yr 1971 Total 163,783 Mean 449 Max 6,610 Min 11 CFSM .58 IN 7,87
Wtr Yr 1972 Total 214,791 Mean 587 Max 11,200 Min 14 CFSM .76 IN 10,32

Table 11

04198000 Sandusky River near Fremont, Ohio

LOCATION.--Lat 41°18'28", long 83°09'32", sec.17,T.4N., R.15E., Sandusky County, on left bank at downstream side of county road bridge, 2.e miles upstream from Ballville diversion dam, 2.5 miles downstream from Wolf Creek, and 3.5 miles southwest of Fremont.

DRAINAGE AREA.--1,251 sq mi.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR AUGUST 1971 TO JUNE 1972

Day	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
1	89	39	41	39	62	1,640	180	190	440	660	600
2	77	35	39	41	62	1,610	160	2,610	392	640	526
3	65	33	37	41	57	940	180	6,380	361	553	473
4	57	33	35	39	55	630	240	5,120	369	473	415
5	54	34	33	37	55	520	300	3,460	384	415	490
6	52	40	31	33	62	460	250	1,900	384	369	384
7	49	42	28	35	97	500	230	1,100	392	323	281
8	47	42	29	37	172	560	210	740	1,790	316	223
9	45	38	35	37	187	399	200	600	2,590	3,050	187
10	46	35	51	39	235	808	190	500	2,290	6,430	172
11	49	39	47	41	223	1,850	180	540	1,830	4,990	156
12	51	55	37	39	177	2,160	170	499	1,320	3,700	141
13	47	52	37	39	141	1,450	170	1,880	1,430	2,160	482
14	45	48	53	39	129	840	240	7,700	3,940	1,250	738
15	43	44	55	41	267	600	340	7,620	4,020	3,000	1,200
16	40	39	49	41	465	440	500	6,190	3,630	5,740	1,610
17	41	36	51	41	703	360	900	5,120	5,400	5,320	969
18	40	35	49	41	715	300	1,500	4,090	5,300	4,190	670
19	37	35	45	45	526	270	1.100	2,760	4,190	2,460	482
20	37	40	41	47	353	250	700	1,710	4,880	1,300	369
21	40	55	37	45	248	300	460	1,210	8,660	886	288

22	136	52	35	45	193	400	360	1,380	12,300	670	235
23	105	49	37	45	161	600	280	3,460	16,500	535	210
24	54	51	39	45	141	1,000	240	3,390	12,600	440	193
25	41	54	45	49	137	700	200	2,020	7,400	369	177
26	41	53	47	47	129	500	180	1,250	3,510	309	172
27	41	61	43	49	125	420	160	940	1,830	267	182
28	40	56	41	53	113	360	150	761	1,260	235	150
29	39	50	41	51	109	300	140	640	940	217	235
30	40	47	41	62	172	240	------	562	749	260	726
31	39	------	39	------	499	200	------	499	------	482	------
TOTAL	1.627	1,322	1,268	1,283	6,770	21,607	10,110	76,821	111,081	52,009	13,136
MEAN	552.5	44.0	40.9	42.8	218	697	349	2,478	3,703	1,678	438
MAX	136	61	55	62	715	2,160	1,500	7,700	16,500	6,430	1,610
MIN	37	33	28	33	55	200	140	190	361	217	141
CFSM	.04	.04	.03	.03	.17	.56	.28	1.98	2.96	1.34	.35
IN.	.05	.04	.04	.04	.20	.64	.30	2.28	3.30	1.55	.39

Cal Yr 1971 Total 314,072 Mean 860 Max 19,900 Min 28 CFSM .69 IN 9.34
Wtr Yr 1972 Total 334,750 Mean 915 Max 16,500 Min 28 CFSM .73 IN 9.95

Table 12

04199000 Huron River at Milan, Ohio

LOCATION.--Lat 41°18'06", long 82°36'25", in SW 1/4 sec. 4, T.5N, R. 22W., Erie County, on right bank 500 ft downstream from bridge on U.S. Highway 250, 0.2 mile northwest of Milan and 2 miles downstream from confluence of East and West Branches.

DRAINAGE AREA.--371 sq mi.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR AUGUST 1971 TO JUNE 1972

Day	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
1	17	8.6	9.1	24	33	328	36	181	168	160	125
2	15	8.6	7.7	28	29	199	32	3,140	156	172	104
3	13	7.7	6.3	19	23	175	36	2,020	144	148	88
4	12	10	7.7	18	25	165	42	622	152	123	229
5	12	13	8.2	15	27	141	50	378	144	106	372
6	11	7.7	10	15	37	128	44	236	129	96	174
7	9.6	8.2	11	18	75	110	40	238	138	102	111
8	9.1	8.2	9.6	14	114	101	36	220	172	116	82
9	11	6.3	19	16	134	141	32	208	178	1,630	67
10	12	6.3	19	20	92	1,020	30	168	194	1,220	58
11	23	6.0	19	19	75	700	28	158	188	526	45
12	13	6.0	18	19	67	402	26	172	176	332	41
13	12	12	18	20	65	200	30	2,110	228	250	1,000
14	11	14	38	19	66	120	40	3,460	455	298	2,050
15	13	12	20	19	263	95	352	1,260	603	1,240	712
16	12	12	17	19	494	80	646	937	766	1,150	874
17	11	11	15	16	245	70	450	1,170	1,560	658	452
18	11	9.1	15	17	139	65	260	721	760	395	250
19	12	7.7	15	21	100	70	210	493	450	292	180
20	11	24	19	21	89	80	190	372	1,320	230	142
21	9.6	23	19	23	81	95	170	320	1,730	194	123
22	16	16	19	24	75	130	156	1,330	2,840	180	119

23	12	13	19	20	65	170	192	1,200	1,920	132	245	
24	12	11	21	21	62	240	129	508	751	118	380	
25	11	10	24	19	52	210	101	388	460	102	300	
26	9.1	13	19	19	50	130	89	312	342	88	335	
27	9.1	19	21	24	48	90	90	262	270	75	320	
28	8.2	15	19	24	48	70	86	228	222	78	222	
29	6.8	12	19	29	46	70	101	218	190	63	452	
30	8.6	11	18	42	227	50	-----	212	168	110	808	
31	9.1	----			788	42	-----	186	-----	148	-----	
TOTAL	363.2	341.4	515.6	622	3,734	5,677	3,724	23,428	16,974	10,521	10,460	
MEAN	11.7	11.4										
MAX	23	24										
MIN	6.8	6.0										
CFSM	.03	.03										
IN.	.04	.03										
Calendar Yr		64,980.2										

Table 13

04212000 Grand River near Madison, Ohio

LOCATION.--Lat 41°44'26", long 81°02'48", Lake County, on downstream and of center pier of abandoned highway bridge, 800 ft upstream from State Highway 528, 0.8 mile upstream from Griswold Creek and 2.1 miles south of Madison.

DRAINAGE AREA.--581 sq mi.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR AUGUST 1971 TO JUNE 1972

Day	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
1	9.0	37	19	73	2,160	2,590	220	2,800	397	280	136
2	7.5	21	35	72	1,320	1,650	210	9,380	369	372	205
3	6.3	14	35	68	900	1,540	240	9,000	354	555	207
4	5.6	13	32	92	682	1,340	300	4,980	381	590	205
5	4.8	12	22	125	519	984	315	3,540	433	492	203
6	3.8	14	16	110	1,040	716	318	2,450	418	411	148
7	3.2	11	19	125	3,760	555	300	1,890	381	351	110
8	2.8	11	19	151	5,400	453	270	3,020	348	315	87
9	2.1	5.9	32	154	4,000	418	250	3,040	336	773	80
10	2.1	4.5	122	145	2,640	496	240	2,040	339	2,040	80
11	2.1	3.2	186	170	2,280	734	250	1,510	325	1,600	76
12	2.1	2.8	199	201	1,920	837	300	1,470	308	1,090	73
13	1.9	12	229	168	1,360	752	400	2,080	622	758	90
14	1.5	29	177	125	872	630	500	4,280	1,120	488	126
15	1.5	24	112	92	1,370	414	700	4,230	1,060	366	239
16	1.5	26	71	73	2,960	250	1,000	3,590	3,660	336	908
17	1.5	48	45	62	2,340	280	1,200	4,380	5,720	351	1,370
18	1.3	43	36	54	1,660	240	1,200	3,690	3,730	422	758
19	1.2	31	31	50	1,430	550	1,100	2,580	2,490	425	378
20	1.2	32	22	58	1,170	1,540	950	1,920	2,050	381	241
21	1.2	31	17	130	1,030	1,240	850	1,220	2,270	325	172
22	.91	24	14	400	907	956	800	1,060	1,860	280	140

23	1.7	21	13	453	682	1,400	750	1,730	2,200	241	2,690
24	.91	34	11	360	546	1,550	700	1,480	1,800	211	6,190
25	.91	38	9.5	318	429	1,690	650	1,230	1,320	161	7,380
26	1.2	33	23	308	433	1,370	600	1,020	977	118	5,230
27	1.9	29	74	369	710	740	550	837	645	100	2,580
28	15	31	74	570	858	478	1,600	666	429	86	1,110
29	25	34	78	886	851	368	1,500	519	348	76	560
30	81	22	92	1,980	1,760	292	-------	453	300	74	461
31	76	------	82	------	3,860	250	------	433	------	86	------
TOTAL	268.73	691.4	1,946.5	7,942	51,849	27,298	18,263	82,511	36,990	14,154	32,233
MEAN	8.67	23.0									
MAX	81	48									
MIN	.91	2.8									
CFSM	.01	.04									
IN.	.02	.04									

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APPENDIX V

PROCEDURES FOR DETERMINATION OF PESTICIDE RESIDUES IN WATER

Appendix V

Procedures for Determination of Pesticide Residues in Water

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General:

All glassware must be thoroughly cleaned, preferrably with Alconox or Micro washing compounds, thoroughly rinsed in clean water, and rinsed with glass distilled acetone before use. Separatory funnels and chromatography columns should be equipped with Teflon stopcocks and Teflon or plastic stoppers. Avoid any use of silicone grease or any other lubricant on any glassware item that comes in contact with the sample.

All solvents used must be re-distilled in all-glass apparatus or must be purchased as pesticide quality solvents. The reagents indicated have been found to work most satisfactory in this laboratory. Reagents obtained from different suppliers sometimes perform differently and thus must be checked out as to their applicability. Aqueous reagent solutions are to be made in double distilled water.

The laboratory technician should run recovery studies at various concentration levels in adapting the methods to his techniques. Because techniques and equipment varies from lab to lab the methods should be checked out before using on a routine basis.

Analysis for Organochlorine Insecticide Residues

Procedure 1. (Procedure 2 differs only in eliminating the use of 10% $Na_2 SO_4$ and using 250 ml of water sample.)

1. Place 500 ml of water in a 1-liter separatory funnel(Teflon stopcock and Teflon or plastic stopper) and add 100 ml of 10% Na_2SO_4 solution.
2. Add 200 ml of glass distilled petroleum ether and extract the aqueous phase by shaking the separatory funnel vigorously for 1 minute.
3. Allow the phases to separate and transfer the aqueous phase to a second 1-liter separatory funnel. (Remove as much aqueous phase as possible by permitting time for complete separation of phases. Swirl separatory funnel to dislodge water droplets on sides of vessel.)
4. Extract the aqueous phase with an additional 100 ml of g.d. petroleum ether. Separate the phases as above and discard the aqueous phase.

5. Combine the two petroleum ether phases and backwash by shaking vigorously with 100 ml of 2% $NaHCO_3$ for 1 minute. Again separate and discard the aqueous phase.

6. Transfer the petroleum ether solution to a 500 ml round bottom evaporation flask (Generally best to carefully pour the solution through the mouth of the separatory funnel in order to avoid water pickup from the funnel stopcock and stem.) and concentrate to about 20 ml volume with a flash evaporator. The temperature of the water bath should not exceed 40° C.

7. Prepare a 19 x 300 mm reservoired Teflon stopcock chromatography column (Kontes) for clean-up purposes by one of the two following procedures.

   A 1. Place a small plug of glass wool in the bottom of the column followed by 4 inches of Activated Florisil (Kensington Scientific Corp., 1399 64th St., Emeryville, California 94608; 60/100 mesh, 650 C activation and pre-tested; stored in an oven at 140° C before use.) and 1 inch of anhydrous Na_2SO_4.

   2. Wash the column with a few mls of glass distilled petroleum ether, discard wash, and then add the concentrated extract to the top surface of the column material.

   3. When the top miniscus of the extract reaches the surface of the column material, elute the column with 200 ml of glass distilled petroleum ether and collect the elute in a 500 ml round bottom evaporation flask at a rate of approximately 1-2 drops per second.

   4. Replace the collection flask with a second 500 ml round bottom evaporation flask and elute the column with 250 ml of glass distilled benzene.

      (Note: Check the elution chart for separation of organochlorine pesticides. Our experience shows that Aldrin, heptachlor, p,p'-DDE, o,p-DDT and some p,p'-DDT elutes in petroleum ether and lindane, heptachlor epoxide, dieldrin, p,p'-DDD, the remainder of p,p'-DDT, and methoxchlor elutes in benzene.)

   5. Concentrate the eluates to an appropriate volume (10-15 ml) by flash evaporation and inject aliquots on the gas chromatograph. Additional concentration may be required with a nitrogen gas jet or cleaned air stream to obtain gas chromatographic response.

   B 1. Place a small plug of glass wool in the bottom of the column followed by 2.5 inches of florisil, 2.5 inches of silica gel (Davison Grade 923, 100-200 mesh, stored in a 140° oven before use.), and 1 inch of anhydrous Na_2SO_4.

2. Wash the column with petroleum ether, add the concentrated extract and elute the column with 250 ml of 5% benzene in petroleum ether followed by 250 ml of benzene as in the previous procedure. (The elution sequence is the same as before except p,p'-DDT seems to elute only in the 5% benzene-petroleum ether.)

3. Concentrate the eluates and inject aliquots on the gas chromatograph.)

   (Note: Recovery values at all concentration levels were generally 90 to 110%.

8. Gas chromatographic conditions were: Barber-Colman Series 5000 equipped with 6 ft. all glass column packed with 1:1 mixture of 10.4% DC-200 plus 15.1% QF-1 on Gas Chrom Q 100-120 mesh; oven temperature 200° C; detector temperature 210° C (Tritium foil Electron Capture); injector temperature 220° C; carrier gas-nitrogen.

9. Confirmation of residues was accomplished by concentrating the eluates to a very small volume and injecting aliquots on an identical column in the same gas chromatographic oven but attached to a microcoulometer detector or by chromatographing on two or more instruments and two or more columns and calculation of "p" values.

10. Calculation of residue concentration based upon comparison of sample peak areas with areas of organochlorine pesticide standards analyzed concurrently each day.

$$\text{Apparent p.p.m.} = \frac{\dfrac{\text{Peak area of sample minus control}}{\text{Peak area per ng standard}} \times \dfrac{\text{volume of sample (ml)}}{\text{volume injected (ul)}}}{\text{wt. (vol) of water sample}}$$

The apparent p.p.m. is then corrected for percent recovery to obtain the actual concentration.

Analysis for Chlorinated Acid Herbicide Residues
(2,4-D; 2,4,5-T; Dicamba, etc.)

1. Place 250 ml of water in a 1-liter separatory funnel and add 100 ml of a solution of 2% $NaHCO_3$ and 0.125% EDTA disodium salt (Disodium dihydrogen ethylenediaminetetraacetate dehydrate manufactured by G. Frederick Smith Chemical Co. The EDTA ties up calcium and heavy metal salts on glassware which, if in sample, would precipitate the acids.)
2. Extract the aqueous phase by adding 200 ml of glass distilled benzene and shaking the contents vigorously for 1 minute. (pH of the aqueous layer should be approximately pH 8.0 at this time.)

3. Separate the phases and discard the benzene phase.

4. Add 100 ml of 0.60N H_2SO_4 to the aqueous solution in the separatory funnel and shake cautiously venting the funnel periodically to permit evolved CO_2 to escape. (pH 1.5 - 2.0 should be condition of aqueous phase at this point.)

5. Add 200 ml of glass distilled benzene and shake vigorously for 1 minute. Vent funnel as required. Separate the phases transferring the aqueous solution to a second separatory funnel. Save the benzene phase.

6. Extract the aqueous phase with an additional 100 ml of g.d. benzene. Separate phases and then combine the benzene phases from the two extractions in a 500 ml round bottom evaporation flask that has been previously acid and acetone washed.

   (Note: After the herbicide acids have been separated from water, care must be taken to prevent loss on glassware. All glassware used from this point on, including the evaporation flasks, must be washed with approximately 0.05N HCl solution and then with glass distilled acetone to remove all traces of HCl. This washing removed calcium and heavy metal salts probably present as carbonates and also CO_2 present in distilled water, etc. that would combine with any cations present.)

7. Evaporate the benzene extract with the flash evaporator to a volume of approximately 5 ml. Transfer the extract to a 15-20 ml centrifuge tube. Rinse the evaporation flask with a small volume of benzene and add to the solution in the centrifuge tube.

8. Prepare a diazomethane methylating apparatus consisting of two 2-hole rubber stoppered 20 x 125 mm test tubes connected with 1/4 inch bent glass tubing. The first glass tube should be connected to a nitrogen source and after bending on a 90° angle placed through the rubber stopper so as to almost touch the bottom of the test tube. The second glass tube should be bent in a flat U-shape with a short end inserted through the second hole of the first rubber stopper (extend 1-2 inches into the test tube) and the long end through the second rubber stopper so as to almost touch the bottom of the second test tube. A second U-shaped glass tube is inserted (short end) in the second hole of the second rubber stopper and the long end left free to insert into the sample centrifuge tube.

9. Place 10-15 ml of glass distilled diethyl ether in the first test tube. In the second test tube place 2 ml of 60% KOH, 2 ml of glass distilled carbitol, and 5 ml of glass distilled diethyl ether. Prepare a new test tube of this nature for each sample to be methylated.

10. Add approximately 50 mgm of Dizald reagent (yellow-orange powder - the quality can be quickly approximated on the end of a micro spatula) to the KOH-carbitol solution, connect the tubes to the nitrogen line, place the sample under the end of the generator so that the diazomethane-nitrogen gas bubbles through the extract.

(Note: The first test tube cleans the nitrogen and saturates it with diethyl ether by bubbling the gas through the ether; the second test tube generates diazomethane again with the nitrogen gas bubbling through the solution; and the sample is thus methylated in the centrifuge tube. The nitrogen gas flow should be regulated to about 5-7 bubbles per second.)

11. Methylate the samples for 1-2 minutes until a faint but brilliant yellow color is evident and then let them stand for about 10 minutes. If the samples are sufficiently clean, aliquots can be injected directly on the gas chromatograph and analyzed with the electron capture detector. In most cases, however, additional cleanup is required to remove extraneous materials.

12. Prepare a chromatography column (19 x 300 mm reservoired) with a glass wool plug, 4 inches of 2% H_2O deactivated florisil, and 1 inch anhydrous Na_2SO_4. (The florisil was deactivated to prevent excessive tailing in elution of the methyl esters.)

13. Wash the column with petroleum ether and elute the methylated herbicides with 200 ml of 10% glass distilled ethyl acetate in glass distilled benzene. Concentrate the eluate on a flash evaporator to a suitable volume.

14. Inject aliquots on the gas chromatograph as discussed in the procedure for organochlorine insecticides. Confirm by microcoulometry or the procedures outlined on page 54.

15. Calculate the residue present by comparison to the response of methylated standards.

Analysis for Atrazine in Water

Procedure 1.

1. Place 500 ml of water in a 1-liter separatory funnel and extract the aqueous layer by shaking vigorously 1-2 minutes with 200 ml of cleaned chloroform. (The chloroform is cleaned by passing it through a large column containing 6-8 inches of Davison 923 silica gel. Discard the silica gel in the column when it becomes transparent in color to chloroform. Refill the column with new silica gel before further use.

2. Separate the phases and extract the aqueous phase a second time with 100 ml of cleaned chloroform.

3. Combine the two chloroform extracts and backwash by shaking it vigorously for 1 minute with 100 ml of 2% $NaHCO_3$. Collect the chloroform phase in a 500 ml round bottom evaporation flask and evaporate with a flash evaporator to almost dryness.

4. Remove the final chloroform under a clean air or nitrogen gas stream.

Dissolve the residue in benzene and inject aliquots on the gas chromatograph. Both electron capture detection and flame thermionic detection can be used. Electron capture with a ^{63}Ni detector provides the greater sensitivity but also the greatest interference. A flame thermionic detector with rubidium chloride salt bead (or potassium chloride as second choice) is the preferred detection system. Several different column combinations may be used including the 10.4% DC-200 plus 15.1% QF-1; 2% OV-210 plus 1% OV-17; 2.5% OV-17; and 1.5% QF-1, all on Gas Chrom Q.

Column temperatures should be 170-180°C; Ni^{63} Electron Capture detector temperature 240-245° C; flame temperature 220-225° C with hydrogen and carrier regulated to give adequate response according to manual but not excessive to cause high temperature and melting of salt bead.

Procedure 2. (Quickest and simplest method.)

1. Place 500 ml of water in a 1-liter separatory funnel and add 100 ml of 10% Na_2SO_4.
2. Extract the aqueous layer with 200 ml of glass distilled benzene by thorough shaking for 1 minute. Separate the phases and extract the aqueous phase with an additional 100 ml of g.d. benzene. Separate the phases and discard the aqueous solution.
3. Combine the benzene layers and backwash by shaking 1 minute with 500 ml of 2% $NaHCO_3$. Separate the phases and discard the aqueous solution.
4. Place the benzene phase in a 500 ml round-bottom evaporation flask and evaporate to the desired volume with a flash evaporator.
5. Inject aliquots of the concentrated extract on the gas chromatographic column and detect with a electron capture or flame thermionic (KCl or rubidium chloride salt bead) detector as in the previous method.

Determination of Organophosphate (and Organochlorine) Insecticides

Procedure 1

1. Place 500 ml of water in a 1-liter separatory funnel. Add 200 ml of glass distilled acetone and mix thoroughly. Add 10 grams of Na_2SO_4 and again mix thoroughly.
2. Extract the insecticide residues with 200 ml of glass distilled petroleum ether by shaking the funnel thoroughly for 1 minute. Separate the phases and extract the aqueous phase a second time with 100 ml g.d. petroleum ether. Separate the phases and discard the aqueous solution.

3. Combine the petroleum ether phases and backwash by shaking with 500 ml of 2% Na_2SO_4. Separate phases, discard the aqueous solution, and transfer the petroleum ether extract (pour from mouth of funnel) to a 500 ml round bottom evaporation flask.

4. Concentrate the extract to an appropriate volume and inject on a gas chromatographic column (oven temperature approximately 180°C; flame and temperature of detector adjusted for optimum sensitivity) and detect organophosphate residues with the flame thermionic detector (KCl bead). The columns indicated in earlier procedures are generally satisfactory.

Procedure 2

1. Same procedure as above through step 3.

2. Concentrate the petroleum ether extract to approximately 20 ml with a flash evaporator (water bath temperature 49° C) and then transfer extract to a prepared chromatography column.

3. The chromatography column (19 x 300 mm reservoired) is prepared by placing a small glass wool plug in the bottom followed by 2-1/2 inches of deactivated florisil (2% H_2O added), 2-1/2 inches of Silica Gel Davison Grade 923, and 1 inch of anhydrous Na_2SO_4. Wash the column with g.d. petroleum ether before adding the sample.

4. Elute the sample on the column with 250 ml of glass distilled benzene to remove the organochlorine insecticides, change receiving 500 ml round bottom flasks and elute the column with 200 ml of 10% ethyl acetate in benzene to remove the organophosphates.

5. Concentrate the above eluates with a flash evaporator to a desired volume and inject aliquots on the gas chromatograph. Organochlorine residues can be detected with the electron-capture detector and organophosphate residues with flame thermionic and electron capture detectors.

Prodecure 3 (For organophosphates that require oxidation to the oxon or sulfone for gas chromatographic determination.)

1. Same procedure as above to step 5 of procedure 2. Evaporate the eluate to just dryness on the flash evaporator.

2. Dissolve the residue in 15 ml of cleaned chloroform and add 5 ml of 10 mg/ml metachloroperbenzoic acid in chloroform. Swirl the flask and let stand for 15 minutes.

3. Place the chloroform solution in a 125 or 250 ml Teflon stopcocked separatory funnel and add 25 ml of 10% sodium meta-bisulfite. Shake the contents in the funnel vigorously for one minute and transfer the chloroform phase to a second separatory funnel.

4. Add 25 ml of saturated sodium bicarbonate to the funnel and shake with the chloroform phase vigorously for 1 minute. Transfer the chloroform layer to another 125 ml separatory funnel and wash two times with 25 ml aliquots of distilled water.

5. Transfer the chloroform phase to a 250 ml round bottom evaporation flask and evaporate just to dryness on the flash evaporator.

6. Dissolve the residue in a known amount of glass distilled benzene and inject aliquots on the gas chromatograph equipped with a KCl flame thermionic detector.

APPENDIX VI

PROCEDURES FOR DETERMINATION OF PESTICIDE RESIDUES IN BOTTOM MUD SEDIMENTS

Appendix VI

Procedures for Determining Pesticide Residues in River Bottom Sediment and Mud

General:

Same general considerations on cleaning of glassware and distillation of solvents as for previous procedures. Recovery studies are also required to determine the efficiency of the procedures.

Representative samples of mud and sediment should be dried to determine the dry weight for calculation. The following procedures, however, utilize the wet mud or sediment after drainage of the excess water.

Calculations are the same as outlined for water samples after determining the dry weight of the sediment.

A. The Analysis for Organochlorine and Organophosphate Insecticide Residues.

Procedure 1: Organochlorine insecticide residues

1. Place 50 grams of mud sample in a Waring Blendor and add 300 ml of glass distilled acetone. Blend the contents at slow speed for 5 minutes at the 30 volt setting on the Variac Voltage Regulator.

2. Filter the blended solution through Whatman No. 1 filter paper in a large conical funnel. Cover the funnel and collecting vessel to minimize evaporation. Measure the filtrate collected.

3. Place a 150 ml aliquot of the filtrate in a 1-liter (teflon stopcock and stopper) separatory funnel and add 500 ml of 2% Na_2SO_4. Shake the contents of the funnel to mix thoroughly (venting as required).

4. Extract the aqueous phase in the separatory funnel with 200 ml of glass distilled petroleum ether by vigorous shaking for 1-2 minutes (vent funnel as required). Separate the phases collecting the petroleum ether in a second 1-liter separatory funnel. Re-extract the aqueous phase with an additional 100 ml of petroleum ether, separate and combine the organic solvent phase with the first extraction.

5. Wash the petroleum ether extract by shaking with 100 ml of 2% $NaHCO_3$ and then transfer the extract to a 500 ml round bottom evaporation flask. Concentrate the extract to an appropriate volume with a rotating flash evaporator (water temperature not exceeding 40° C) and then proceed with the florisil or florisil-silica gel clean-up and gas chromatographic analysis indicated for analysis of water samples.

Note: If the background is too great for accurate gas chromatographic analysis, additional clean-up will be required.

Procedure 2: Organophosphate insecticide residues

1. Place 100 g of soil in the Waring Blendor and 400 ml of glass distilled acetone. Blend the material and filter as indicated in Procedure 1 above.

2. Place a 200 ml aliquot of extract in the 1-liter separatory funnel with 500 ml of 2% Na_2SO_4 and extract with petroleum ether as outlined above.

3. Wash the combined petroleum ether with 500 ml of 2% Na_2SO_4, transfer to a round bottom evaporation flask and after concentrating the solution to an appropriate volume inject aliquots on the gas chromatograph equipped with the thermionic detector.

Procedure 3: Organophosphate insecticide residues (when additional clean-up is necessary)

1. Follow the same procedure as outlined above to and including the concentrating of volume by rotary flash evaporation. Then follow the column clean-up procedure as outlined previously for organophosphate residue in water samples using florisil and silica gel.

2. Wash the column with petroleum ether and then elute with 250 ml of glass distilled benzene (contains organochlorines) followed by 200 ml of 10% ethyl acetate in benzene (contains the organophosphates).

3. Concentrate the separate eluates with the flash evaporator and inject aliquots of the organochlorine extract on the gas chromatograph equipped with electron capture detection and the organophosphate extract on the gas chromatograph equipped with thermionic detection.

Procedure 3 utilizes the sample extraction, etc. of Procedure 2 above and is used for simultaneous determination and the procedures outlined for simultaneous analysis in water samples.

Note: These procedures will not always provide adequate clean-up of some extremely dirty samples. Additional clean-up may be required, particularly for organochlorine residue determination. The use of a Sweep Co-Distillation Apparatus at 180° - 185° C oven temperature, Storherr columns packed with silanized glass wool and the mini-scrubber column of anachrom will provide as good if not better clean-up of extracts for analysis of organophosphates by theriomic detection as will the florisil-silica gel column clean-up.

B. Analysis for Chlorophenoxy Acid Herbicide Residues (2,4-D; 2,4,5-T; Dicamba; etc.) (See procedure for analysis of water)

1. Fifty grams of sample is blended with 500 ml of 2% $NaHCO_3$ + 0.125% EDTA solution in the Waring Blendor for 5 minutes and the solution filtered as outlined previously.

2. The volume of solution is measured and recorded and the entire sample extracted in a 1-liter separatory funnel with 200 ml of glass distilled benzene.

3. After discarding the benzene add 100 ml of 3.0 N H_2SO_4(pH of aqueous phase now = 1.0) and extract with 200 ml of benzene as outlined for the water analysis.

4. An emulsion forms in the above extraction. After phases separate as much as possible, separate and discard the aqueous phase and transfer the emulsion to 250 ml centrifuge bottles. Balance the weight and centrifuge at 2000 rpm for 20 minutes (If bottles break,the speed of the centrifugation will need to be reduced appropriately.

5. Separate the organic phase and proceed with the evaporation (HCL washed glassware), methylation, clean-up and measurement as outlined previously for water analysis.

C. Analysis for Triazine Herbicides

1. Blend 100 g of sample in a Waring Blendor (slow speed) with 400 ml of acetone for 3 minutes. Then add 125 ml of distilled water and blend for another 3 minutes.

2. Filter the solution through Whatman No. 1 filter paper and collect in a 16 oz. bottle. Take care to avoid excessive evaporation.

3. Transfer 1/2 of the total extract to a 1-liter separatory funnel, add 500 ml of 2% Na_2SO_4 and extract by vigorous shaking with 250 ml of glass distilled benzene.

4. Backwash the benzene twice with 500 ml aliquots of 2% $NaHCO_3$ and then evaporate the benzene extract to approximately 5 ml volume.

5. Prepare a 20 x 350 mm reservoired column containing from top to bottom 1 inch anhydrous Na_2SO_4, 15 gram (Approx. 2-1/2 - 3 inches of polyethylene coated alumina (Kensington Corp.), and 15 g (2-1/2 -3 inches) of Aluminum Oxide - Woelm Act Grade IV.

6. Place the extract on the column. Wash the material on the column with 200 ml of petroleum ether. Then elute the triazines from the column with 250 ml of NH_3 saturated benzene.

7. Concentrate the eluate to an appropriate volume and inject aliquots on the gas chromatograph equipped with thermionic detection. (Note: Too much background due to inadequate clean-up reduces sensitivity on the capture detector.

8. Follow detection and calculation procedures as outlined for analysis of water samples.

APPENDIX VII

PESTICIDE RESIDUES IN RIVER WATER AND BOTTOM SEDIMENT SAMPLES

APPENDIX VII

a. Explanation of code number in sample identification.

Nine digit sample number

River Number	Sampling Site	Type of Sample	Date of Sampling		
			Month	Day	Year
1	1	2	05	16	72

Rivers are identified by number:

1. Maumee
2. Portage
3. Sandusky
4. Huron
5. Grand
6. Lake Erie Islands

Sampling site 1-6 or 7 on each river as indicated in Appendix I

Sample Identification:

1. Water
2. Bottom Sediment
3. Clams

b. Sensitivity level for residues by analytical methods employed:

Pesticide Type	Water	Bottom Sediment
Organochlorine Insecticide	1 ppt	10 ppt
Organophosphate Insecticide	0.1 ppb	1 ppb
Triazine Herbicides	0.5 ppb	1 ppb
Chlorophenoxy Acid Herbicides	0.5 ppb	1 ppb

Blank spaces indicate that analytical results were not conclusive enough to identify and quantitate data.

An * indicates that representative peaks for the residue involved were resolved by two or more gas chromatographic systems but the "p" values did not correspond with book or laboratory experimental values.

"N" indicates no residue detected at the sensitivity level of the method as specified.

Table 14. Organochlorine Insecticide Residues in River Water and Bottom Sediment Samples

Sample No. *	Insecticide Residue ppt											
	1 Aldrin	2 Dieldrin	3 Heptachlor	4 Heptachlor Epoxide	5 Lindane	6 Methoxychlor	7 o,p-DDE	8 p,p'-DDE	9 o,p-DDD	10 p,p'-DDD	11 o,p-DDT	12 p,p-DDT
111092071	N	N				N			N	N		
121092071	N					N			N	N		
131092071	N					N			N	N		
141092071	N	N				N	N	N	N	N	N	N
151092771	N		N	N		N	N	N	N	N	N	N
161092771	N	N				N	N	N	N	N	N	N
171092771	N	N				N	N	N	N	N	N	N
111102771	N		N	N		N	N	N	N	N	N	N
121102771	N		N	N		N	N	N	N	N	N	N
131102771	N		N	N		N	N	N	N	N	N	N
141102771	N					N	N	N	N	N	N	N
151112471	N		N	N		N	N	N	N		N	N
161112471	N		N	N		N			N	N	N	N
171112471	N	N	N	N		N	N		N	N	N	N
111120371	N	N	N	N	N	N	N	N	N	N	N	N
121120371	N	N	N	N	N	N	N	N	N	N	N	N
131120371	N	N	N	N	N	N	N	N	N	N	N	N
141120371	N	N	N	N	N	N	N	N	N	N	N	N
111032472	N	N	N	N	N	N	N	N	N	N	N	N
121032472	N	N	N	N	N	N	N	N	N	N	N	N
131032472	N	N	N	N	N	N	N	N	N	N	N	N
141032472	N	N	N	N	N	N	N	N	N	N	N	N
111041872	N	N	N	N	N	N	N	N	N	N	N	N
121041872	N	N	N	N	N	N	N	N	N	N	N	N
131041872	N	N	N	N	N	N	N	N	N	N	N	N
141041872	N	N	N	N	N	N	N	N	N	N	N	N
161050172	N	N	N	N	N	N	N	N	N	N	N	N
111051772	N	N	N	N	N	N	N	N	N	N	N	N
121051772	N	N	N	N	N	N	N	N	N	N	N	N
131051772	N		N				N	N			N	N
141051772	N	N	N	N	N	N	N	N	N	N	N	N
151060872	N	N	N	N	N	N	N	N	N	N	N	N
161069872	N	N	N	N	N	N	N	N	N	N	N	N
111061572	N	N	N	N	N	N	N	N	N	N	N	N
121061572	N	N	N	N	N	N	N	N	N	N	N	N
131061572	N	N	N	N	N	N	N	N	N	N	N	N
141061572	N	N	N	N	N	N	N	N	N	N	N	N
111062372	N	N	N	N	N	N	N	N	N	N	N	N
121062872	N	N	N	N	N	N	N	N	N	N	N	N
131062872	N	N	N	N	N	N	N	N	N	N	N	N

*See key for identification of samples and sensitivity of detection of residues on page 66.

Table 14. Organochlorine Insecticide Residues in River Water and Bottom Sediment Samples

Sample No. *	Insecticide Residue ppt											
	I Aldrin	2 Dieldrin	3 Heptachlor	4 Heptachlor Epoxide	5 Lindane	6 Methoxychlor	7 o,p-DDE	8 p,p'-DDE	9 o,p-DDD	10 p,p'-DDD	11 o,p-DDT	12 p,p-DDT
141062872	N	N	N	N	N	N	N	N	N	N	N	N
211091671			NO	SAMPLE	ANALYZED							
221091671	N		N				N	N			N	N
231091671			NO	SAMPLE	ANALYZED							
241091671			NO	SAMPLE	ANALYZED							
251091671	N	N	N	N	N	N	N	N	N	N	N	N
261092771	N		N	N		N			N	N	N	N
271092771	N	N	N	N		N	N	N	N	N	N	N
211102671	N	N	N	N	N	N	N	N	N	N	N	N
221102671	N	N	N	N	N	N	N	N	N	N	N	N
231102671	N	N	N	*	*	N	N	N	N	N	N	N
241102671	N	N	N	N	N	N	N	N	N	N	N	N
251102671	N		N	N		N	N	N	N	N	N	N
261102671	N	N	N	N	N	N	N	N	N	N	N	N
211120271	N	N	N	N	N	N	N	N	N	N	N	N
221120271	N	N	N	N	N	N	N	N	N	N	N	N
231120271	N	N	N	N	N	N	N	N	N	N	N	N
241120271	N	N	N	N	N	N	N	N	N	N	N	N
251120271	N	N	N	N	N	N	N	N	N	N	N	N
261120171	N	N	N	N	N	N	N	N	N	N	N	N
211032472	N	N	N	N	N	N	N	N	N	N	N	N
221032472	N	N	N	N	N	N	N	N	N	N	N	N
231032472	N	N	N	N	N	N	N	N	N	N	N	N
241032472	N	N	N	N	N	N	N	N	N	N	N	N
251032472	N	N	N	N	N	N	N	N	N	N	N	N
261032472	N	N	N	N	N	N	N	N	N	N	N	N
211031872	N	N	N	N	N	N	N	N	N	N	N	N
221041872	N	N	N	N	N	N	N	N	N	N	N	N
231041872	N	N	N	N	N	N	N	N	N	N	N	N
241041872	N	N	N	N	N	N	N	N	N	N	N	N
251041872	N	N	N	N	N	N	N	N	N	N	N	N
261041972	N	N	N	N	N	N	N	N	N	N	N	N
271041972	N	N	N	N	N	N	N	N	N	N	N	N
211051772	N	N	N	N	N	N	N	N	N	N	N	N
221051772	N	N	N	N	N	N	N	N	N	N	N	N
231051772	N	N	N	N	N	N	N	N	N	N	N	N
241051772	N	N	N	N	N	N	N	N	N	N	N	N
251051772	N	N	N	N	N	N	N	N	N	N	N	N
261060872	N	N	N	N	N	N	N	N	N	N	N	N
271060872	N	N	N	N	N	N	N	N	N	N	N	N

*See key for identification of samples and sensitivity of detection of residues on Page 66.

Table 14. Organochlorine Insecticide Residues in River Water and Bottom Sediment Samples

Sample No. *	Insecticide Residue ppt											
	1 Aldrin	2 Dieldrin	3 Heptachlor	4 Heptachlor Epoxide	5 Lindane	6 Methoxychlor	7 o,p-DDE	8 p,p'-DDE	9 o,p-DDD	10 p,p'-DDD	11 o,p-DDT	12 p,p-DDT
211061572			NO SAMPLE ANALYZED									
221061572	N	N	N	N	N	N	N	N	N	N	N	N
231061572			NO SAMPLE ANALYZED									
241061572	N	N	N	N	N	N	N	N	N	N	N	N
251061572			NO SAMPLE ANALYZED									
211062872	N	N	N	N	N	N	N	N	N	N	N	N
221062872	N	N	N	N	N	N	N	N	N	N	N	N
231062872	N	N	N	N	N	N	N	N	N	N	N	N
241062872	N	N	N	N	N	N	N	N	N	N	N	N
251062872	N	N	N	N	N	N	N	N	N	N	N	N
361092771	N	N	N	N	N	N			N	N		
311100471	N		N	N		N	N		N	N	N	N
321100471	N		N	N		N	N	N	N	N	N	N
331100471	N		N	N		N	N	N	N	N	N	N
341100471	N	N	N	N	N	N	N	N	N	N	N	N
351100571	N	N	N	N	N	N	N	N	N	N	N	N
311110871	N		N	N		N	N	N	N	N	N	N
321110871	N		N	N		N	N		N	N		
331110871	N	N	N	N	N	N	N	N	N	N	N	N
341110871	N		N	N		N	N	N	N	N		
351110871	N	N	N	N	N	N	N	N	N	N	N	N
371110871	N	N	N	N	N	N	N	N	N	N	N	N
311121471	N	N	N	N	N	N	N	N	N	N	N	N
321121471	N	N	N	N	N	N	N	N	N	N	N	N
331121471	N	N	N	N	N	N	N	N	N	N	N	N
341121471	N	N	N	N	N	N	N	N	N	N	N	N
351121471	N	N	N	N	N	N	N	N	N	N	N	N
311032072	N	N	N	N	N	N	N	N	N	N	N	N
321032072	N	N	N	N	N	N	N	N	N	N	N	N
331032072	N	N	N	N	N	N	N	N	N	N	N	N
341032072	N	N	N	N	N	N	N	N	N	N	N	N
351032072	N	N	N	N	N	N	N	N	N	N	N	N
311041772	N	N	N	N	N	N	N	N	N	N	N	N
321041772	N	N	N	N	N	N	N	N	N	N	N	N
331041772	N	N	N	N	N	N	N	N	N	N	N	N
341041772	N	N	N	N	N	N	N	N	N	N	N	N
351041772	N	N	N	N	N	N	N	N	N	N	N	N
311051672	N	N	N	N	N	N	N	N	N	N	N	N
321051672	N	N	N	N	N	N	N	N	N	N	N	N
331051672	N	N	N	N	N	N	N	N	N	N	N	N

*See key for identification of samples and sensitivity of detection of residues on page 66.

Table 14. Organochlorine Insecticide Residues in River Water and Bottom Sediment Samples

Sample No. *	Insecticide Residue ppt											
	1 Aldrin	2 Dieldrin	3 Heptachlor	4 Heptachlor Epoxide	5 Lindane	6 Methoxychlor	7 o,p-DDE	8 p,p'-DDE	9 o,p-DDD	10 p,p'-DDD	11 o,p-DDT	12 p,p-DDT
341051672	N	N	N	N	N	N	N	N	N	N	N	N
351051672	N	N	N	N	N	N	N	N	N	N	N	N
311061472	N	N										
321061472	N	N	N	N	N	N	N	N	N	N	N	N
331061472	N	N	N	N	N	N	N	N	N	N	N	N
341061472	N	N	N	N	N	N	N	N	N	N	N	N
351061472	N	N	N	N	N	N	N	N	N	N	N	N
311062772	N	N	N	N	N	N	N	N	N	N	N	N
321062772	N	N	N	N	N	N	N	N	N	N	N	N
331062772	N	N	N	N	N	N	N	N	N	N	N	N
341062772	N	N	N	N	N	N	N	N	N	N	N	N
351062772	N	N	N	N	N	N	N	N	N	N	N	N
411093071			N	N		N	N		N	N		
421093071	N	N										
431093071	N	N	N	N	N	N	N	N	N	N	N	N
441093071	N	N										
451093071	N											
461093071	N	*	N	N	N	N	N	N	N	N	N	N
411110871	N	N	N	N	N	N	N		N	N		
421110871	N	N	N	N	N	N	N		N	N		
431110871	N		N	N		N	N		N	N		
441110871	N	N	N	N		N	N		N			
451110871	N	N	N	N	N	N	N	N	N	N	N	N
461110871	N	N	N	N	N	N	N	N	N	N	N	N
411121471	N	N	N	N	N	N	N	N	N	N	N	N
421121471	N	N	N	N	N	N	N	N	N	N	N	N
431121471	N	N	N	N	N	N	N	N	N	N	N	N
441121471	N	N	N	N	N	N	N	N	N	N	N	N
451121471	N	N	N	N	N	N	N	N	N	N	N	N
411032072	N	N	N	N	N	N	N	N	N	N	N	N
421032072	N	N	N	N	N	N	N	N	N	N	N	N
431032072	N	N	N	N	N	N	N	N	N	N	N	N
441032072	N	N	N	N	N	N	N	N	N	N	N	N
461032072	N	N	N	N	N	N	N	N	N	N	N	N
411041772			NO	SAMPLE	ANALYZED							
421041772	N	N	N	N	N	N	N	N	N	N	N	N
431041772	N	N	N	N	N	N	N	N	N	N	N	N
441041772	N	N	N	N	N	N	N	N	N	N	N	N
451041772	N	N	N	N	N	N	N	N	N	N	N	N
461041772	N	N	N	N	N	N	N	N	N	N	N	N

*See key for identification of samples and sensitivity of detection of residues on page 66.

Table 14. Organochlorine Insecticide Residues in River Water and Bottom Sediment Samples

Sample No. *	Insecticide Residue ppt											
	1	2	3	4	5	6	7	8	9	10	11	12
	Aldrin	Dieldrin	Heptachlor	Heptachlor Epoxide	Lindane	Methoxychlor	o,p-DDE	p,p'-DDE	o,p-DDD	p,p'-DDD	o,p-DDT	p,p-DDT
411051672	N											
421051672			NO SAMPLE ANALYZED									
431051672			NO SAMPLE ANALYZED									
441051672	N											
451051672	N	N										
461051672	N	N	N	N	N	N	N	N	N	N	N	N
411061472			NO SAMPLE ANALYZED									
421061472	N	*	N	N	N	N	N	N	N	N	N	N
431061472	N	*	N	N	N	N	N	N	N	N	N	N
441061472	N	*	N	N	N	N	N	N	N	N	N	N
461061472	N	N	N	N	N	N	N	N	N	N	N	N
411062772	N	N	N	N	N	N	N	N	N	N	N	N
421062772	N	N	N	N	N	N	N	N	N	N	N	N
431062772	N	N	N	N	N	N	N	N	N	N	N	N
441062772	N	N	N	N	N	N	N	N	N	N	N	N
461062772	N	N	N	N	N	N	N	N	N	N	N	N
511082371	N	N	N	N		N	N	N	N		N	N
521082371	N	N	N	N	N	N	N	N	N	N	N	N
531082371	N	N	N	N	N	N	N	N	N	N	N	N
541082371	N	N	N	N	N	N	N	N	N	N	N	N
551082371	N	N	N	N	N	N	N	N	N	N	N	N
561082371	N	N	N	N	N	N	N	N	N	N	N	N
511092371	N	N	N	N	N	N	N	N	N	N	N	N
521092371	N	N	N	N	N	N	N	N	N	N	N	N
541092371	N	N	N	N	N	N	N	N	N	N	N	N
551092371	N	N	N	N	N	N	N	N	N	N	N	N
561092371	N	N	N	N	N	N	N	N	N	N	N	N
571092371	N	N	N	N	N	N	N	N	N	N	N	N
511110471	N	N	N	N	N	N	N	N	N	N	N	N
521110471	N	N	N	N	N	N	N	N	N	N	N	N
541110471	N	N	N	N	N	N	N	N	N	N	N	N
561110471	N	N	N	N	N	N	N	N	N	N	N	N
57111047	N	N	N	N	N	N	N	N	N	N	N	N
511121371	N	N	N	N	N	N	N	N	N	N	N	N
521121371	N	N	N	N	N	N	N	N	N	N	N	N
541121371	N	N	N	N	N	N	N	N	N	N	N	N
561121371	N	N	N	N	N	N	N	N	N	N	N	N
571121371	N	N	N	N	N	N	N	N	N	N	N	N
511032072	N	N	N	N	N	N	N	N	N	N	N	N
521032172	N	N	N	N	N	N	N	N	N	N	N	N

*See key for identification of samples and sensitivity of detection of residues on page 66.

Table 14. Organochlorine Insecticide Residues in River Water and Bottom Sediment Samples

Sample No. *	Insecticide Residue ppt-Water; ppb - Bottom Sediment											
	1 Aldrin	2 Dieldrin	3 Heptachlor	4 Heptachlor Epoxide	5 Lindane	6 Methoxychlor	7 o,p-DDE	8 p,p'-DDE	9 o,p-DDD	10 p,p'-DDD	11 o,p-DDT	12 p,p-DDT
551032172	N	N	N	N	N	N	N	N	N	N	N	N
561032172	N	N	N	N	N	N	N	N	N	N	N	N
571032172	N	N	N	N	N	N	N	N	N	N	N	N
511042772	N	N	N	N	N	N	N	N	N	N	N	N
521042772	N	N	N	N	N	N	N	N	N	N	N	N
551042772	N	N	N	N	N	N	N	N	N	N	N	N
561042772	N	N	N	N	N	N	N	N	N	N	N	N
571042772	N	N	N	N	N	N	N	N	N	N	N	N
511051872	N	N	N	N	N	N	N	N	N	N	N	N
521051872	N	N	N	N	N	N	N	N	N	N	N	N
551051872	N	N	N	N	N	N	N	N	N	N	N	N
561051872	N	N	N	N	N	N	N	N	N	N	N	N
571051872	N	N	N	N	N	N	N	N	N	N	N	N
511061772	N	N	N	N	N	N	N	N	N	N	N	N
521061772	N	N	N	N	N	N	N	N	N	N	N	N
551061772	N	N	N	N	N	N	N	N	N	N	N	N
561061772	N	N	N	N	N	N	N	N	N	N	N	N
571061872	N	N	N	N	N	N	N	N	N	N	N	N
511063072	N	N	N	N	N	N	N	N	N	N	N	N
521063072	N	N	N	N	N	N	N	N	N	N	N	N
551063072	N	N	N	N	N	N	N	N	N	N	N	N
561063072	N	N	N	N	N	N	N	N	N	N	N	N
571063072	N	N	N	N	N	N	N	N	N	N	N	N
112092071	N	N	N	N	N	N	N	N	N	N	N	N
122092071	N	N	N	N	N	N	N	N	N	N	N	N
132092071	N	N	N	N	N	N	N	N	N	N	N	N
142092071	N	N	N	N	N	N	N	N	N	N	N	N
152092771	N		N	N	N	N	N	N	N	N	N	N
162092771	N	N	N	N	N	N	N	N	N	24.80	N	N
172092771			NO SAMPLE OBTAINED									
112102771	N	N	N	N	N	N	N	N	N	N	N	N
122102771												
132102771	N	8.11	N	N	N	N	N	N	N	N	N	N
142102771	N	7.10	N	N	N	N	N	N	N	N	N	N
152112471	N	N	N	N	N	N	N	N	N	*	N	N
162112471			NO SAMPLE OBTAINED									
172112471	N	N	N	N	N	N	N	N	N	*	N	N
112120371	N	N	N	N	N	N	N	N	N	N	N	N
122120371	N	N	N	N	N	N	N	N	N	N	N	N
132120371	N	3.54	N	N	N	N	N	N	N	N	N	N

*See key for identification of samples and sensitivity of detection of residues on page 66.

Table 14. Organochlorine Insecticide Residues in River Water and Bottom Sediment Samples

Sample No. *	Insecticide Residue ppb											
	1 Aldrin	2 Dieldrin	3 Heptachlor	4 Heptachlor Epoxide	5 Lindane	6 Methoxychlor	7 o,p-DDE	8 p,p'-DDE	9 o,p-DDD	10 p,p'-DDD	11 o,p-DDT	12 p,p-DDT
142120371	N	N	N	N	N	N	N	N	N	N	N	N
112032472			NO	SAMPLE	OBTAINED							
122032472	N	N	N	N	N	N	N	N	N	N	N	N
132032472	N	N	N	N	N	N	N	N	N	N	N	N
142032472	N	N	N	N	N	N	N	N	N	N	N	N
112041872			NO	SAMPLE	OBTAINED							
122041872			NO	SAMPLE	OBTAINED							
132041872	N	N	N	N	N	N	N	N	N	N	N	N
142041872	N	N	N	N	N	N	N	N	N	N	N	N
162050172	N	N	N	N	N	N	N	N	N	N	N	N
112051772			NO	SAMPLE	OBTAINED							
122051772			NO	SAMPLE	OBTAINED							
132051772	N	7.55	N	N	N	N	N	N	N	2.26	N	N
142051772	N	N	N	N	N	N	N	N	N	N	N	N
152060872	N	N	N	N	N	N	N	N	N	4.94	N	N
162060872				N	N	N						
112061572	N	N	N	N	N	N	N	N	N	N	N	N
122061572			NO	SAMPLE	OBTAINED							
132061572			NO	SAMPLE	ANALYZED							
142061572		N		N	N	N			N	N		
162061372	N	N	N	N	N	N	N	N	N	N	N	N
112062872	N	N	N	N	N	N	N	N	N	N	N	N
122062872	N	N	N	N	N	N	N	N	N	N	N	N
132062872	N	N	N	N	N	N	N	N	N	N	N	N
142062872	N	N	N	N	N	N	N	N	N	N	N	N
212091671	N	*	N	N	N	N	N	N	N	N	N	N
222091671	N	1.40	N	N	N	N	N	N	N	N	N	N
232091671			NO	SAMPLE	ANALYZED							
242091671			NO	SAMPLE	OBTAINED							
252091671	N	N	N	N	N	N	N	N	N	N	N	N
262092771	N	N	N	N	N	N	N	N	N	0.90	N	N
272092771	N	N	N	N	N	N	N	N	N	7.93	N	N
212102671	N	N	N	N	N	N	N	N	N	N	N	N
222102671	N	N	N	N	N	N	N	N	N	N	N	N
232102671	N	N	N	N	N	N	N	N	N	N	N	N
242102671	N	*	N	N	N	N	N	N	N	N	N	N
252102671			NO	SAMPLE	OBTAINED							
262102671			NO	SAMPLE	OBTAINED							
212120271	N	N	N	N	N	N	N	N	N	N	N	N
222120271	N	N	N	N	N	N	N	N	N	N	N	N

*See key for identification of samples and sensitivity of detection of residues on page 66.

Table 14. Organochlorine Insecticide Residues in River Water and Bottom Sediment Samples

Sample No. *	Insecticide Residue ppb											
	1 Aldrin	2 Dieldrin	3 Heptachlor	4 Heptachlor Epoxide	5 Lindane	6 Methoxychlor	7 o,p-DDE	8 p,p'-DDE	9 o,p-DDD	10 p,p'-DDD	11 o,p-DDT	12 p,p-DDT
232120271	N	N	N	N	N	N	N	N	N	N	N	N
242120271	N	N	N	N	N	N	N	N	N	N	N	N
252120271	N	N	N	N	N	N	N	N	N	N	N	N
262120171	N	N	N	N	N	N	N	N	N	N	N	N
212032472	N	*	N	N	N	N	N	N	N	*	N	N
222032472			NO	SAMPLE	ANALYZED							
232023472			NO	SAMPLE	ANALYZED							
242032472	N	N	N	N	N	N	N	N	N	N	N	N
252032472	N	N	N	N	N	N	N	N	N	N	N	N
262032472	N	N	N	N	N	N	N	N	N	N	N	N
212041872	N	*	N	N	N	N	N	*	N	*	N	N
222041872			NO	SAMPLE	OBTAINED							
232041872	N	N	N	N	N	N	N	N	N	N	N	N
242041872			NO	SAMPLE	OBTAINED							
252041872			NO	SAMPLE	ANALYZED							
262041972	N	N	N	N	N	N	N	N	N	N	N	N
272041972			NO	SAMPLE	OBTAINED							
212051772	N	*	N	N	N	N	N	N	N	*	N	N
222051772			NO	SAMPLE	OBTAINED							
232051772	N	10.99	N	N	N	N	N	N	N	5.14	N	N
242051772			NO	SAMPLE	OBTAINED							
252051772	N	N	N	N	N	N	N	N	N	14.40	N	N
262060872	N	N	N	N	N	N	N	N	N	N	N	N
272068072	N	N	N	N	N	N	N	N	N	N	N	N
212061572	N	*	N	N	N	N	N	N	N	*	N	N
222061572			NO	SAMPLE	ANALYZED							
232061572	N	*	N	N	N	N	N	N	N	N	N	N
242061572			NO	SAMPLE	ANALYZED							
252061572	N	*	N	N	N	N	N	*	N	*	N	N
212062872	N	N	N	N	N	N	N	N	N	N	N	N
222062872	N	N	N	N	N	N	N	N	N	N	N	N
232062872			NO	SAMPLE	ANALYZED							
242062872	N	*	N	N	*	N	N	N	*	*	N	N
252062872	N	N	N	N	N	N	N	N	N	N	N	N
362092771	N	1.06	N	N	N	N	N	N	N	3.24	N	N
312100471	N	2.34	N	N	N	N	N	N	N	N	N	N
322100471			NO	SAMPLE	ANALYZED							
332100471	N	N	N	N	N	N	N	N	N	N	N	N
342100471	N	*	N	N	N	N	N	N	N	*	N	N
352100571			NO	SAMPLE	OBTAINED							

*See key for identification of samples and sensitivity of detection of residues on page 66

Table 14. Organochlorine Insecticide Residues in River Water and Bottom Sediment Samples

Sample No. *	Insecticide Residue ppb											
	I	2	3	4	5	6	7	8	9	10	11	12
	Aldrin	Dieldrin	Heptachlor	Heptachlor Epoxide	Lindane	Methoxychlor	o,p-DDE	p,p'-DDE	o,p-DDD	p,p'-DDD	o,p-DDT	p,p-DDT
312110871	N	N	N	N	N	N	N	N	N	N	N	N
322110871	N	*	N	N	N	N	N	N	N	N	N	N
332110871			NO	SAMPLE	ANALYZED							
342110871	N	N	N	N	N	N	N	N	N	3.00	N	N
352110871			NO	SAMPLE	OBTAINED							
372110871			NO	SAMPLE	OBTAINED							
312121471	N	N	N	N	N	N	N	N	N	N	N	N
322121471	N	N	N	N	N	N	N	N	N	N	N	N
332121471	N	N	N	N	N	N	N	N	N	N	N	N
342121471	N	N	N	N	N	N	N	N	N	N	N	N
352121471			NO	SAMPLE	OBTAINED							
312032072	N	N	N	N	N	N	N	N	N	N	N	N
322032072	N	N	N	N	N	N	N	N	N	N	N	N
332032072	N	N	N	N	N	N	N	N	N	N	N	N
342032072	N		N				N	34.60			N	N
352032072			NO	SAMPLE	OBTAINED							
312041772			NO	SAMPLE	ANALYZED							
322041772	N	N	N	N	N	N	N	N	N	N	N	N
332041772	N	N	N	0.30	N	N	N	N	N	0.90	N	N
342041772	N	N	N	N	N	N	N	N	N	N	N	N
352041772			NO	SAMPLE	OBTAINED							
312051672	N	N	N	N	N	N	N	N	N	N	N	N
322051672	N	N	N	0.40	N	N	N	N	N	N	N	N
332051672	N		N	N	N	N	N	N	N	N	N	N
342051672	N	3.63	N	N	N	N	N	N	N	N	N	N
352051672			NO	SAMPLE	OBTAINED							
312061472	N	N	N	N	N	N	N	N	N	N	N	N
322061472	N	N	N	N	N	N	N	N	N	N	N	N
332061472	N	N	N	N	N	N	N	N	N	N	N	N
342061472	N	N	N	N	N	N	N	N	N	N	N	N
352061472			NO	SAMPLE	OBTAINED							
312062772	N	N	N	N	N	N	N	N	N	N	N	N
322062772	N	N	N	N	N	N	N	N	N	N	N	N
332062772	N	N	N	N	N	N	N	N	N	N	N	N
342062772			NO	SAMPLE	ANALYZED							
352062772			NO	SAMPLE	OBTAINED							
412093071			NO	SAMPLE	ANALYZED							
422093071	N	N	N	N	N	N	N	N	N	N	N	N
432093071	N	N	N	N	N	N	N	N	N	N	N	N
442093071	N	N	N	N	N	N	N	3.10	N	N	N	N

*See key for identification of samples and sensitivity of detection of residues on page 66.

Table 14. Organochlorine Insecticide Residues in River Water and Bottom Sediment Samples

Sample No. *	Insecticide Residue ppb											
	1 Aldrin	2 Dieldrin	3 Heptachlor	4 Heptachlor Epoxide	5 Lindane	6 Methoxychlor	7 o,p-DDE	8 p,p'-DDE	9 o,p-DDD	10 p,p'-DDD	11 o,p-DDT	12 p,p-DDT
452093071	N	2.88	N	N	N	N	N	N	N	1.35	N	N
462093071	N	N	N	N	N	N	N	N	N	N	N	N
412110871	N	*	N	N	N	N	N	N	N	N	N	N
422110871	N	N	N	N	N	N	N	N	N	N	N	N
432110871	N	2.76	N	N	N	N	N	N	N	N	N	N
442110871	N	N	N	N	N	N	N	N	N	N	N	N
452110871	N	3.27	N	N	N	N	N	N	N	1.43	N	N
462110871	N	N	N	N	N	N	N	N	N	N	N	N
412121471	N	N	N	N	N	N	N	N	N	N	N	N
422121471	N	N	N	N	N	N	N	N	N	N	N	N
432121471	N	17.6	N	N	N	N	N	N	N	N	N	N
442121471	N	N	N	N	N	N	N	N	N	N	N	N
452121471	N	N	N	N	N	N	N	N	N	N	N	N
412032072	N	N	N	N	N	N	N	N	N	N	N	N
422032072	N	N	N	N	N	N	N	N	N	N	N	N
432032072	N	N	N	N	N	N	N	N	N	N	N	N
442032072	N	N	N	N	N	N	N	N	N	N	N	N
462032072	N	N	N	N	N	N	N	N	N	N	N	N
412041772			NO	SAMPLE	ANALYZED							
422041772			NO	SAMPLE	ANALYZED							
432041772	N	N	N	N	N	N	N	N	N	N	N	N
442041772	N	N	N	N	N	N	N	N	N	N	N	N
452041772	N	N	N	N	N	N	N	N	N	N	N	N
462041772	N	N	N	N	N	N	N	N	N	N	N	N
412051672	N	N	N	N	N	N	N	2.10	N	N	N	5.10
422051672			NO	SAMPLE	OBTAINED							
432051672	N	5.39	N	N	N	N	N	N	N	N	N	16.44
442051672	N	*	N	N	N	N			N	N		
452051672	N	N	N	N	N	N	N	N	N	N	N	N
462051672			NO	SAMPLE	ANALYZED							
412061472	N	3.43	N	N	N	N	N	N	N	N	N	N
422061472	N	*	N	N	N	N	N	N	N	N	N	N
432061472	N	5.89	N	N	N	N	N	N	N	N	N	N
442061472	N	7.40	N	N	N	N	N	N	N	0.70	N	N
462061472			NO	SAMPLE	ANALYZED							
412062772		N		0.5	N	N			N	N		
422062772	N	N	N	N	N	N	N	N	N	N	N	N
432062772	N	N	N	N	N	N	N	N	N		N	N
442062772												
462062772	N	N	N	N	N	N	N	N	N	N	N	N

*See key for identification of samples and sensitivity of detection of residues on page 66.

Table 14. Organochlorine Insecticide Residues in River Water and Bottom Sediment Samples

Sample No. *	Insecticide Residue ppb											
	1 Aldrin	2 Dieldrin	3 Heptachlor	4 Heptachlor Epoxide	5 Lindane	6 Methoxychlor	7 o,p-DDE	8 p,p'-DDE	9 o,p-DDD	10 p,p'-DDD	11 o,p-DDT	12 p,p-DDT
512082371			NO	SAMPLE	OBTAINED							
522082371			NO	SAMPLE	OBTAINED							
532082371			NO	SAMPLE	OBTAINED							
542082371			NO	SAMPLE	OBTAINED							
552082371			NO	SAMPLE	OBTAINED							
562082371			NO	SAMPLE	OBTAINED							
512092371	N	N	N	N	N	N	N	N	N	N	N	N
522092371	N	N	N	N	N	N	N	N	N	N	N	N
542092371	N	*	N	N	N	N	N	N	N	N	N	N
552092371	N	N	N	N	N	N	N	N	N	5.83	N	N
562092371	N	N	N	N	N	N	N	N	N	N	N	N
572092371			NO	SAMPLE	OBTAINED							
512110471	N	N	N	N	N	N	N	N	N	N	N	N
522110471	N	N	N	N	N	N	N	N	N	N	N	N
542110471			NO	SAMPLE	OBTAINED							
562110471	N	N	N	N	N	N	N	N	N	N	N	N
572110471			NO	SAMPLE	OBTAINED							
512121371	N	N	N	N	N	N	N	N	N	N	N	N
522121371	N	N	N	N	N	N	N	N	N	N	N	N
542121371			N	N	N							
552121371	N	N	N	N	N	N	N	N	N	N	N	N
562121371			N	N	N							
572121371			NO	SAMPLE	OBTAINED							
512032072	N	N	N	N	N	N	N	N	N	N	N	N
522032172	N	N	N	N	N	N	N	N	N	N	N	N
552032172	N	N	N	N	N	N	N	N	N	N	N	N
562032172			NO	SAMPLE	OBTAINED							
572032172			NO	SAMPLE	OBTAINED							
512042772	N	N	N	N	N	N	N	N	N	N	N	N
522042772	N	N	N	N	N	N	N	N	N	N	N	N
552042772	N	N	N	N	N	N	N	N	N	N	N	N
562042772			NO	SAMPLE	OBTAINED							
572042772			NO	SAMPLE	OBTAINED							
512051872	N		N				N	N			N	N
522051872	N	N	N	N	N	N	N	N	N	N	N	N
552051872	N	N	N	N	N	N	N	N	N	N	N	N
562051872			NO	SAMPLE	OBTAINED							
572051872	N	N	N	N	N	N	N	N	N	N	N	N
512061772	N	N	N	N	N	N	N	N	N	N	N	N
522061772	N	N	N	N	N	N	N	N	N	N	N	N

*See key for identification of samples and sensitivity of detection of residues on page 66.

Table 14. Organochlorine Insecticide Residues in River Water and Bottom Sediment Samples

Sample No. *	Insecticide Residue ppb											
	1 Aldrin	2 Dieldrin	3 Heptachlor	4 Heptachlor Epoxide	5 Lindane	6 Methoxychlor	7 o,p-DDE	8 p,p'-DDE	9 o,p-DDD	10 p,p'-DDD	11 o,p-DDT	12 p,p-DDT
552061772	N	N	N	N	N	N	N	2.25	N	N	N	N
562061872			NO	SAMPLE	OBTAINED							
572061872	N	N	N	N	N	N	N	N	N	158.54	N	N
512063072	N	N	N	N	N	N	N	N	N	N	N	N
522063072	N	N	N	N	N	N	N	N	N	N	N	N
552063072	N	N	N	N	N	N	N	N	N	N	N	N
562063072			NO	SAMPLE	OBTAINED							
572063072	N	N	N	N	N	N	N	N	N	N	N	N

*See key for identification of samples and sensitivity of detection of residues on page 66.

Table 15. Triazine Type Herbicide Residues in River Water and Bottom Sediment Samples.

Sample No. *	Herbicide Residue ppb		
	Atrazine	Simazine	Bladex
111092071	N	N	N
121092071	N	N	N
131092071	N	N	N
141092071	N	N	N
151092771	N	N	N
161092271	N	N	N
171092771	N	N	N
111102771	N	N	N
121102771	N	N	N
131102771	N	N	N
141102771	N	N	N
151112471	N	N	N
161112471	N	N	N
171112471	N	N	N
111120371	N	N	N
121120371	N	N	N
131120371	N	N	N
141120371	N	N	N
111032472	No Sample analyzed		
121032472	N	N	N
131032472	N	N	N
141032472	N	N	N
111041872	N	N	N
121041872	N	N	N
131041872	N	N	N
141041872	N	N	N
161040172	N	N	N
111051772	N	N	N
121051772	11.86	N	N
131051772	N	N	N
141051772	N	N	N
151060872	N	N	N
161060872	N	N	N
111061572	N	N	N
121061572	N	N	N
131061572	N	N	N
141061572	N	N	N
111062872	N	N	N
121062872	N	N	N
131062872	N	N	N
141062872	N	N	N
211091671	N	N	N
221091671	N	N	N
231091671	N	N	N
241091671	N	N	N
251091671	N	N	N
261091671	N	N	N

Sample No.*	Herbicide Residue ppb		
	Atrazine	Simazine	Bladex
271092771	N	N	N
211102671	N	N	N
221102671	N	N	N
231102671	N	N	N
241102671	N	N	N
251102671	N	N	N
261102671	N	N	N
211120271	N	N	N
221120271	N	N	N
231120271	N	N	N
241120271	N	N	N
251120271	N	N	N
261120171	N	N	N
211032472	N	N	N
221032472	N	N	N
231032472	N	N	N
241032472	N	N	N
251032472	N	N	N
261032972	N	N	N
211041872	N	N	N
221041872	N	N	N
231041872	N	N	N
241041872	N	N	N
251041872	N	N	N
261041972	N	N	N
271041972	N	N	N
211051772	N	N	N
221051772	N	N	N
231051772	N	N	N
241051772	N	N	N
251051772	N	N	N
261060872	N	N	N
271060872	N	N	N
211061572	N	N	N
221061572	56.00	N	N
231061572	N	N	N
241061572	N	N	N
251061572	N	N	N
211062872	N	N	N
221062872	N	N	N
23162872	N	N	N
241062872	N	N	N
251062872	N	N	N
361092771	N	N	N
311100471	N	N	N
321100471	N	N	N
331100471	N	N	N

*See key for identification of samples and sensitivity of detection of residues on page 66.

Table 15. Triazine Type Herbicide Residues in River Water and Bottom Sediment Samples.

Sample No. *	Herbicide Residue ppb		
	Atrazine	Simazine	Bladex
341100471	N	N	N
351100571	N	N	N
311110871	N	N	N
321110871	N	N	N
331110871	N	N	N
341110871	N	N	N
351110871	N	N	N
371110871	N	N	N
311121471	N	N	N
321121471	N	N	N
331121471	N	N	N
341121471	N	N	N
351121471	N	N	N
311032072	N	N	N
321032072	N	N	N
331032072	N	N	N
341032072	N	N	N
351032072	N	N	N
311041772	N	N	N
321041772	N	N	N
331041772	N	N	N
341041772	N	N	N
351041772	N	N	N
311051672	N	N	N
321051672	N	N	N
331051672	N	N	N
341051672	N	N	N
351051672	N	N	N
311061472	N	N	N
321061472	N	N	N
331061472	27.62	N	N
341061472	N	N	N
351061472	N	32.40	N
311062772	N	N	N
321062772	N	N	N
331062772	N	N	N
341062772	N	N	N
351062772	N	29.93	N
411093071	N	N	N
421093071	N	N	N
431093071	N	N	N
441093071	N	N	N
451093071	N	N	N
461093071	N	N	N
411110871	N	N	N
421110871	N	N	N
431110871	N	N	N
441110871	N	N	N
451110871	N	N	N
461110871	N	N	N
411121471	N	N	N
421121471	N	N	N
431121471	N	N	N
441121471	N	N	N
451121471	N	N	N
411032072	N	N	N
421032072	N	N	N
431032072	N	N	N
441032072	N	N	N
461032072	N	N	N
411041772	N	N	N
421041772	N	N	N
431041772	N	N	N
441041772	N	N	N
451041772	N	N	N
461041772	N	N	N
411051672	16.17	N	N
421051672	14.72	N	N
431051672	22.65	N	N
441051672	14.08	N	N
451051672	N	N	N
461051672	N	N	N
411061472	N	N	N
421061472	N	238.86	N
431061472	N	N	N
441061472	2.73	N	N
461061472	2.95	N	N
411062772	N	26.40	N
421062772	N	N	N
431062772	N	N	N
441062772	69.44	N	N
461062772	N	N	N
511082371	N	N	N
521082371	N	N	N
531082371	N	N	N
541082371	N	N	N
551082371	N	N	N
561082371	N	N	N
511092371	N	N	N
521092371	N	N	N
541092371	N	N	N
551092371	N	N	N
561092371	N	N	N
571092371	N	N	N

*See key for identification of samples and sensitivity of detection of residues on page 66.

Table 15. Triazine Type Herbicide Residues in River Water and Bottom Sediment Samples.

Sample No. *	Herbicide Residue ppb		
	Atrazine	Simazine	Bladex
511110471	N	N	N
521110471	N	N	N
541110471	N	N	N
561110371	N	N	N
571110471	N	N	N
511121371	N	N	N
521121371	N	N	N
541121371	No Sample analyzed		
561121371	N	N	N
571121371	N	N	N
511032072	N	N	N
521032172	N	N	N
551032172	N	N	N
561032172	N	N	N
571032172	N	N	N
511042772	N	N	N
521042772	N	N	N
551042772	N	N	N
561042772	N	N	N
571042772	N	N	N
511051872	N	N	N
521051872	N	N	N
551051872	N	N	N
561051872	N	N	N
571051872	No Sample analyzed		
511061772	N	N	N
521061772	N	N	N
551061772	N	N	N
561061872	N	N	N
571061872	N	N	N
511063072	N	N	N
521063072	N	N	N
551063072	N	N	N
561063072	N	N	N
571063072	N	N	N
Bottom Sediment			
112092071	N	N	N
122092071	N	N	N
132092071	N	N	N
142092071	N	N	N
152092771	N	N	N
162092771	N	N	N
172092771	No Sample		
112102771	No Sample analyzed		
132102771	N	N	N
142102771	N	N	N

Sample No.*	Herbicide Residue ppb		
	Atrazine	Simazine	Bladex
152112471	N	N	N
172112471	N	N	N
112120371	N	N	N
132120371	N	N	N
142120371	No Sample analyzed		
122032472	N	N	N
132032472	N	N	N
142032472	N	N	N
132041872	N	N	N
142041872	N	N	N
162050172	N	N	N
132051772	24.98	N	N
142051772	N	N	N
152060872	N	N	N
162060872	N	N	N
112061572	N	N	N
132061572	N	N	N
142061572	N	N	N
112062872	N	N	N
122062872	N	N	N
132062872	26.33	N	N
142062872	N	N	N
212091671	N	N	N
222091671	N	N	N
232091671	N	N	N
252091671	N	N	N
262092771	N	N	N
272092771	N	N	N
212102671	N	N	N
222102671	N	N	N
232102671	N	N	N
242102671	N	N	N
252102671	No Sample		
212120271	N	N	N
222120271	No Sample analyzed		
232120271	N	N	N
242120271	N	N	N
252120271	No Sample analyzed		
262120171	N	N	N
212032472	N	N	N
232032472	N	N	N
242032472	N	N	N
252032472	N	N	N
262032972	N	N	N
212041872	N	N	N
232041872	N	N	N
252041872	N	N	N

*See key for identification of samples and sensitivity of detection of residues on page 66.

Table 15. Triazine Type Herbicide Residues in River Water and Bottom Sediment Samples.

Sample No. *	Herbicide Residue ppb		
	Atrazine	Simazine	Bladex
262041972	N	N	N
212051772	47.33	N	N
232051772	N	N	N
252051772	No Sample analyzed		
262060872	N	N	N
272060872	N	N	N
212061572	N	N	N
222061572	No Sample		
232061572	22.73	N	N
242061572	N	N	N
252061572	N	N	N
212062872	No Sample analyzed		
222062872	N	N	N
232062872	N	N	N
242062872	N	N	N
252062872	No Sample		
362092771	No Sample		
312100471	N	N	N
322100471	N	N	N
332100471	N	N	N
342100471	N	N	N
312110871	55.12	N	N
322110871	N	N	N
332110871	N	N	N
342110871	N	N	N
372110871	No Sample		
312121471	N	N	N
322121471	N	N	N
332121471	N	N	N
342121471	N	N	N
312032072	N	N	N
322032072	N	N	N
332032072	N	N	N
342032072	N	N	N
312041772	No Sample		
322041772	N	N	N
332041772	N	N	N
342041772	N	N	N
312051672	No Sample analyzed		
322051672	N	N	N
332051672	N	N	N
342051672	N	N	N
312061472	N	N	N
322061471	N	N	N
332061472	N	N	N
342061472	4.47	N	N
312062772	N	N	N
322062772	N	N	N
332062772	52.16	N	N
342062772	N	N	N
412093071	N	N	N
422093071	N	N	N
432093071	N	N	N
442093071	N	N	N
452093071	N	N	N
462093071	N	N	N
412110871	N	N	N
422110871	N	N	N
432110871	N	N	N
442110871	N	N	N
452110871	N	N	N
462110871	N	N	N
412121471	No Sample analyzed		
422121471	N	N	N
432121471	N	N	N
442121471	N	N	N
452121471	N	N	N
412032072	N	N	N
422032072	No Sample analyzed		
432032072	N	N	N
442032072	N	N	N
462032072	N	N	N
412041772	N	N	N
432041772	N	N	N
442041772	N	N	N
452041772	N	N	N
462041772	N	N	N
412051672	N	N	N
432051672	No Sample		
442051672	46.20	N	N
452051672	N	N	N
462051672	N	N	N
412061472	N	N	N
422061472	76.33	N	N
432061472	95.19	N	N
442061472	N	N	N
462061472	N	N	N
412062772	N	N	N
422062772	25.16	N	N
432062772	No Sample analyzed		
442062772	No Sample analyzed		
462062772	N	N	N
512082371	No Sample		
522082371	No Sample		

*See key for identification of samples and sensitivity of detection of residues on page 66.

Table 15. Triazine Type Herbicide Residues in River Water and Bottom Sediment Samples.

Sample No. *	Herbicide Residue ppb		
	Atrazine	Simazine	Blades
532082371	No Sample		
542082371	No Sample		
512092371	N	N	N
522092371	N	N	N
542092371	N	N	N
552092371	N	N	N
562092371	No Sample analyzed		
512110471	N	N	N
522110471	N	N	N
552110471	N	N	N
562110471	No Sample		
512121371	N	N	N
522121371	N	N	N
552121371	N	N	N
512032072	N	N	N
522032172	N	N	N
552032172	No Sample analyzed		
512042772	N	N	N
522042772	N	N	N
552042772	N	N	N
512051872	N	N	N
522051872	N	N	N
552051872	No Sample analyzed		
572051872	N	N	N
512061772	N	N	N
522061772	N	N	N
552061772	N	N	N
572061872	N	N	N
512063072	N	N	N
522063072	N	N	N
552063072	N	N	N
572063072	N	N	N

Sample No.*	Herbicide Residue ppb		
	Atrazine	Simazine	Bladex

*See key for identification of samples and sensitivity of detection of residues on page 66.

Table 16. Chlorophenoxy Acid Type Herbicide Residues in River Water, Bottom Sediment and Mussel Samples

Sample No. *	Herbicide Residue ppb		
	Dicamba	2,4-D	2,4,5-T
111092071	N	N	N
121092071	N	N	N
131092071	N	N	N
141092071	N	N	N
151092771	N	N	N
161092771	N	N	N
171092771	N	N	N
111102771	N	N	N
121102771	N	N	N
131102771	N	N	N
141102771	N	N	N
151112471	N	N	N
161112471	N	N	N
171112471	N	N	N
111120371	N	N	N
121120371	No Sample analyzed		
131120371	N	N	N
141120371	N	N	N
111032472	N	N	N
121032472	N	N	N
131032472	N	N	N
141032472	N	N	N
111041872	N	N	N
121041872	N	N	N
131041872	N	N	N
141041872	N	N	N
161050172	N	N	N
111051772	N	N	N
121051772	N	N	N
131051772	N	N	N
141051772	N	N	N
151060872	N	N	N
161060872	N	N	N
111061572	N	N	N
121061572	N	N	N
131061572	N	N	N
141061572	N	N	N
111062872	N	N	N
121062872	N	N	N
131062872	No Sample analyzed		
141062872	N	N	N
211091671	N	N	N
221091671	N	N	N
231091671	No Sample analyzed		
241091671	N	N	N
251091671	N	N	N
261091671	N	N	N
271092771	N	N	N
211102671	N	N	N
221102671	N	N	N
231102671	N	N	N
241102671	N	N	N
251102671	N	N	N
261102671	N	N	N
211120271	N	N	N
221120271	N	N	N
231120271	N	N	N
241120271	N	N	N
251120271	N	N	N
261120171	N	N	N
211032472	N	N	N
221032472	N	N	N
231032472	N	N	N
241032472	N	N	N
251032472	N	N	N
261032972	N	N	N
211041872	N	N	N
221041872	N	N	N
231041872	N	N	N
241041872	N	N	N
251041872	N	N	N
261041972	N	N	N
271041972	N	N	N
211051772	N	N	N
221051772	N	N	N
231051772	N	N	N
241051772	N	N	N
251051772	N	N	N
261060872	N	N	N
271060872	N	N	N
211061572	N	N	N
221061572	N	N	N
231061572	N	N	N
241061572	N	N	N
251061572	N	N	N
211062872	N	N	7.0
221062872	N	N	N
231062872	N	N	N
241062872	N	N	N
251062872	N	N	N
361092771	N	N	N
311100471	N	N	N
321100471	N	N	N
331100471	N	N	N

*See key for identification of samples and sensitinity of detection of residues on page 66

Table 16. Chlorophenoxy Acid Type Herbicide Residues in River Water, Bottom Sediment and Mussel Samples

Sample No. *	Herbicide Residue ppb		
	Dicamba	2,4-D	2,4,5-T
341100471	N	N	N
351100571	N	N	N
311110871	N	N	N
321110871	N	N	N
331110871	N	N	N
341110871	N	N	N
351110871	N	N	N
371110871	N	N	N
311121471	N	N	N
321121471	N	N	N
331121471	N	N	N
341121471	N	N	N
351121471	No Sample analyzed		
311032072	N	N	N
321032072	N	N	N
331032072	N	N	N
341032072	N	N	N
351032072	N	N	N
311041772	N	N	N
321041772	N	N	N
331041772	N	N	N
341041772	N	N	N
351041772	N	N	N
311051672	N	N	N
321051672	N	N	N
331051672	N	N	N
341051672	N	N	N
351051672	N	N	N
311061472	N	N	N
321061472	N	N	N
331061472	N	N	N
341061472	N	N	N
351061472	N	N	N
311062772	No Sample analyzed		
321062772	N	N	N
331062772	N	N	N
341062772	N	N	N
351062772	N	N	N
411093071	No Sample analyzed		
421093071	N	N	N
431093071	N	N	N
441093071	N	N	N
451093071	No Sample analyzed		
461093071	N	N	N
411110871	N	N	N
421110871	N	N	N
431110871	N	N	N

Sample No.*	Herbicide Residue ppb		
	Dicamba	2,4-D	2,4,5-T
441110871	N	N	N
451110871	N	N	N
461110871	N	N	N
411121471	N	N	N
421121471	N	N	N
431121471	N	N	N
441121471	N	N	N
451121471	N	N	N
411032072	N	N	N
421032072	N	N	N
431032072	N	N	N
441032072	N	N	N
461032072	N	N	N
411041772	N	N	N
421041772	N	N	N
431041772	N	N	N
441041772	N	N	N
451041772	N	N	N
461041772	N	N	N
411051672	N	N	N
421051672	N	N	N
431051672	N	N	N
441051672	N	N	N
451051672	N	N	N
461051672	N	N	N
411061472	N	N	N
421061472	N	N	N
431061472	N	N	N
441061472	N	N	N
461061472	N	N	N
411062772	N	N	N
421062772	N	N	N
431062772	N	N	N
441062772	N	N	N
461062772	N	N	N
511082371	N	N	N
521082371	N	N	N
531082371	N	N	N
541082371	N	N	N
551082371	N	N	N
561082371	N	N	N
511092371	N	N	N
521092371	N	N	N
541092371	N	N	N
551092371	N	N	N
561092371	N	N	N
571092371	N	N	N

*See key for identification of samples and sensitivity of detection of residues on page 66

Table 16. Chlorophenoxy Acid Type Herbicide Residues in River Water, Bottom Sediment and Mussel Samples

Sample No. *	Herbicide Residue ppb		
	Dicamba	2,4-D	2,4,5-T
511110471	N	N	N
521110471	N	N	N
541110471	N	N	N
561110471	N	N	N
571110471	No Sample analyzed		
511121371	N	N	N
521121371	N	N	N
541121371	N	N	N
561121371	N	N	N
571121371	N	N	N
511032072	N	N	N
521032172			
551032172	N	N	N
561032172	N	N	N
571032172	N	N	N
511042772	N	N	N
521042772	N	N	N
551042772	N	N	N
561042772	N	N	N
571042772	N	N	N
511051872	N	N	N
521051872	N	N	N
551051872	N	N	N
561051872	N	N	N
571051872	N	N	N
511061772	N	N	N
521061772	N	N	N
551061772	N	N	N
561061872	N	N	N
571061872	N	N	N
511063072	N	N	N
521063072	N	N	N
551063072	N	N	N
561063072	N	N	N
571063072	N	N	N
Bottom Sediment			
112092071	N	N	N
122092071	N	N	N
132092071	N	N	N
142092071	N	N	N
152092771	N	N	N
162092771	No Sample analyzed		
172092771	No Sample		
112102771	N	N	N
132102771	N	N	N
142102771	N	N	N
152112471	N	N	N
172112471	N	N	N
112120371	N	N	N
132120371	No Sample analyzed		
142120371	N	N	N
122032472	N	N	N
132032472	N	N	N
142032472	N	N	N
132041872	N	N	N
142041872	N	N	N
162050172	No Sample analyzed		
132051772	N	N	N
142051772	N	N	N
152060872	N	N	N
162060872	N	N	N
112061572	N	N	N
132061572	N	N	N
142061572	N	N	N
112062872	No Sample analyzed		
122062872	No Sample analyzed		
132062872	No Sample analyzed		
142062872	No Sample analyzed		
212091671	N	N	N
222091671	N	N	N
232091671	N	N	N
252091671	N	N	N
262092771	No Sample analyzed		
272092771	N	N	N
212102671	N	N	N
222102671	N	N	N
232102671	N	N	N
242102671	N	N	N
252102671	No Sample		
212120271	N	N	N
222120271	N	N	N
232120271	No Sample analyzed		
242120271	N	N	N
252120171	N	N	N
262120171	N	N	N
212032472	No Sample analyzed		
232032472	No Sample analyzed		
252032472	N	N	N
262032972	N	N	N
212041872	N	N	N
232041872	N	N	N
252041872	N	N	N
262041972	N	N	N

*See key for identification of samples and sensitivity of detection of residues on page 66

Table 16. Chlorophenoxy Acid Type Herbicide Residues in River Water, Bottom Sediment and Mussel Samples

Sample No. *	Herbicide Residue ppb		
	Dicamba	2 4-D	2,4 5-T
212051772	N	N	N
232051772	N	N	N
252051772	N	N	N
262060872	N	N	N
272060872	N	N	N
212061572	N	N	N
222061572	N	N	N
232061572	N	N	N
242051572	N	N	N
252061572	N	N	N
212062872	N	N	N
222062872	N	N	N
232062872	No Sample analyzed		
242062872	No Sample analyzed		
252062872	No Sample		
312100471	N	N	N
322100471	N	N	N
332100471	N	N	N
342100471	N	N	N
362092771	N	N	N
312110871	N	N	N
322110871	N	N	N
332110871	N	N	N
342110871	N	N	N
372110871	No Sample		
312121471	N	N	N
322121471	N	N	N
332121471	N	N	N
342121471	N	N	N
312032072	N	N	N
322032072	N	N	N
332032072	N	N	N
342032072	N	N	N
312041772	No Sample		
322041772	N	N	N
332041772	N	N	N
342041772	N	N	N
312051672	N	N	N
322051672	No Sample analyzed		
332051672	No Sample analyzed		
342051672	No Sample analyzed		
312061472	N	N	N
322061472	N	N	N
332061472	N	N	N
342061472	N	N	N
312062772	N	N	N
322062772	N	N	N
332062772	N	N	N
342062772	N	N	N
412093071	N	N	N
422093071	N	N	N
432093071	No Sample analyzed		
442093071	N	N	N
452093071	N	N	N
462093071	N	N	N
412110871	N	N	N
422110871	N	N	N
432110871	N	N	N
442110871	N	N	N
452110871	N	N	N
462110871	N	N	N
412121471	N	N	N
422121471	N	N	N
432121471	N	N	N
442121471	N	N	N
452121471	N	N	N
412032072	N	N	N
422032072	N	N	N
432032072	N	N	N
442032072	N	N	N
462032072	N	N	N
412041772	N	N	N
432041772	N	N	N
442041772	N	N	N
452041772	N	N	N
462041772	N	N	N
412051672	N	N	N
432051672	No Sample analyzed		
442051672	No Sample analyzed		
452051672	No Sample analyzed		
462051672	22.7	N	N
412061472	N	N	N
422061472	N	N	N
432061472	N	N	N
442061472	N	N	N
462061472	N	N	N
412062772	No Sample analyzed		
422062772	No Sample analyzed		
432062772	N	N	N
442062772	N	N	N
462062772	N	N	N
512082371	No Sample		
522082371	No Sample		
532082371	No Sample		

*See key for identification of samples and sensitivity of detection of residues on page 66

Table 16. Chlorophenoxy Acid Type Herbicide Residues in River Water, Bottom Sediment and Mussel Samples

Sample No. *	Herbicide Residue ppb		
	Dicamba	2, 4-D	2,4,5-T
542082371	No Sample		
512092371	N	N	N
522092371	N	N	N
542092371	N	N	N
552092371	No Sample analyzed		
562092371	N	N	N
512110471	N	N	N
522110471	No Sample analyzed		
552110471	N	N	N
562110471	No Sample analyzed		
512121371	N	N	N
522121371	N	N	N
552121371	N	N	N
512032072	N	N	N
522032172	N	N	N
552032172	N	N	N
512042772	N	N	N
522042772	N	N	N
552042772	N	N	N
512051872	No Sample analyzed		
522051872	N	N	N
552051872	N	N	N
572051872	N	N	N
512061772	N	N	N
522061772	N	N	N
552061772	N	N	N
512063072	No Sample analyzed		
522063072	No Sample analyzed		
552063072	No Sample analyzed		
572063072	N	N	N
Mussels	Samples not analyzed		
113093071	"	" "	
223091671	"	" "	
253091671	"	" "	
223102671	"	" "	
223062872	"	" "	
333100471	"	" "	
343100471	"	" "	
333110871	"	" "	
343110871	"	" "	
333061472	"	" "	
333062772	"	" "	
343063772	"	" "	
513082371	"	" "	
523082371	"	" "	
543082371	"	" "	
553082371	Samples not analyzed		
563082371	"	"	"
523092371	"	"	"
543092371	"	"	"
553092371	"	"	"
563092371	"	"	"
513051872	"	"	"
513061772	"	"	"

*See key for identification of samples and sensitivity of detection of residues on page 66

Table 17. Organophosphate Insecticide Residues in River Water and Bottom Sediment Samples.

Sample No.*	Insecticide Residue ppb				
	Diazinon	Methyl Parathion	Ethyl Parathion	Malathion	Thimet
111032472	N	N	N	N	N
121032472	N	N	N	N	N
131032472	N	N	N	N	N
141032472	N	N	N	N	N
111041872	N	N	N	N	N
121041872	N	N	N	N	N
131041872	N	N	N	N	N
141041872	N	N	N	N	N
161050172	N	N	N	N	N
111051772	N	N	N	N	N
121051772	N	N	N	N	N
131051772	N	N	N	N	N
141051772	N	N	N	N	N
151060872	N	N	N	N	N
161060872	N	N	N	N	N
111061572	N	N	N	N	N
121061572	N	N	N	N	N
131061572	N	N	N	N	N
141061572	N	N	N	N	N
111062872	N	N	N	N	N
121062872	N	N	N	N	N
131062872	N	N	N	N	N
141062872	N	N	N	N	N
251120171	N	N	N	N	N
211032472	N	N	N	N	N
221032472	N	N	N	N	N
231032472	N	N	N	N	N
241032472	N	N	N	N	N
251032472	N	N	N	N	N
261032972	N	N	N	N	N
211041872	N	N	N	N	N
221041872	N	N	N	N	N
231041872	N	N	N	N	N
241041872	N	N	N	N	N
251041872	N	N	N	N	N
261041872	N	N	N	N	N
271041972	N	N	N	N	N
211051772	N	N	N	N	N
221051772	N	N	N	N	N
231051772	N	N	N	N	N
241051772	N	N	N	N	N
251051772	N	N	N	N	N
261060872	N	N	N	N	N
271060872	N	N	N	N	N
211061572	N	N	N	N	N
221061572	N	N	N	N	N

*See key for identification of samples and sensitivity of detection of residues on page 66

Table 17. Organophosphate Insecticide Residues in River Water and Bottom Sediment Samples.

Sample No.*	Insecticide Residue ppb				
	Diazinon	Methyl Parathion	Ethyl Parathion	Malathion	Thimet
231061572	N	N	N	N	N
241061572	N	N	N	N	N
251061572	N	N	N	N	N
221062872	N	N	N	N	N
231062872	N	N	N	N	N
241062872	N	N	N	N	N
251062872	N	N	N	N	N
311032072	N	N	N	N	N
321032072	N	N	N	N	N
331032072	N	N	N	N	N
341032072	N	N	N	N	N
351032072	N	N	N	N	N
311041772	N	N	N	N	N
321041772	N	N	N	N	N
331041772	N	N	N	N	N
341041772	N	N	N	N	N
311051672	N	N	N	N	N
321051672	N	N	N	N	N
331051672	N	N	N	N	N
341051672	N	N	N	N	N
351051672	N	N	N	N	N
311061472	N	N	N	N	N
321061472	N	N	N	N	N
331061472	N	N	N	N	N
341061472	N	N	N	N	N
351061472	N	N	N	N	N
311062772	N	N	N	N	N
321062772	N	N	N	N	N
331062772	N	N	N	N	N
341062772	N	N	N	N	N
351062772	N	N	N	N	N
411041772	N	N	N	N	N
421041772	N	N	N	N	N
431041772	N	N	N	N	N
441041772	N	N	N	N	N
451041772	N	N	N	N	N
461041772	N	N	N	N	N
411051672	N	N	N	N	N
421051672	N	N	N	N	N
431051672	N	N	N	N	N
441051672	N	N	N	N	N
451051672	N	N	N	N	N
461051672	N	N	N	N	N
411061472	N	N	N	N	N
421061472	N	N	N	N	N
431061472	N	N	N	N	N

*See key for identification of samples and sensitivity of detection of residues on page 66

Table 17. Organophosphate Insecticide Residues in River Water and Bottom Sediment Samples.

Sample No.*	Insecticide Residue ppb				
	Diazinon	Methyl Parathion	Ethyl Parathion	Malathion	Thimet
441061472	N	N	N	N	N
461061472	N	N	N	N	N
411062772	N	N	N	N	N
421062772	N	N	N	N	N
431062772	N	N	N	N	N
441062772	N	N	N	N	N
461062772	N	N	N	N	N
511032172	N	N	N	N	N
521032172	N	N	N	N	N
551032172	N	N	N	N	N
561032172	N	N	N	N	N
571032172	N	N	N	N	N
511042772	N	N	N	N	N
521042772	N	N	N	N	N
551042772	N	N	N	N	N
561042772	N	N	N	N	N
571042772	N	N	N	N	N
511051872	N	N	N	N	N
521051862	N	N	N	N	N
551051872	N	N	N	N	N
561051872	N	N	N	N	N
571051872	N	N	N	N	N
511061772	N	N	N	N	N
521061772	N	N	N	N	N
551061772	N	N	N	N	N
561061872	N	N	N	N	N
571061872	N	N	N	N	N
521063072	N	N	N	N	N
511063072	N	N	N	N	N
551063072	N	N	N	N	N
561063072	N	N	N	N	N
571063072	N	N	N	N	N
Bottom Sediment					
112092071	N	N	N	N	N
122092071	N	N	N	N	N
132092071	N	N	N	N	N
142092071	N	N	N	N	N
152092771	N	N	N	N	N
162092771	N	N	N	N	N
172092771	NO SAMPLE OBTAINED				
112102771	N	N	N	N	N
122102771					
132102771	N	N	N	N	N
142102771	N	N	N	N	N
152112471	N	N	N	N	N
162112471	NO SAMPLE OBTAINED				

*See key for identification of samples and sensitivity of detection of residues on page 66

Table 17. Organophosphate Insecticide Residues in River Water and Bottom Sediment Samples.

Sample No.*	Insecticide Residue ppb				
	Diazinon	Methyl Parathion	Ethyl Parathion	Malathion	Thimet
172112471	N	N	N	N	N
112120371	N	N	N	N	N
122120371	NO SAMPLE	ANALYZED			
132120371	4.15	N	N	N	N
142120371	N	N	N	N	N
112032472	NO SAMPLE	OBTAINED			
122032472	N	N	N	N	N
132032472	N	N	N	N	N
142032472	N	N	N	N	N
112041872	NO SAMPLE	OBTAINED			
122041872	NO SAMPLE	OBTAINED			
132041872	N	N	N	N	N
142041872	N	N	N	N	N
162050172	N	N	N	N	N
112051772	NO SAMPLE	OBTAINED			
122051772	NO SAMPLE	OBTAINED			
132051772	N	N	N	N	N
142051772	N	N	N	N	N
152060872	N	N	N	N	N
162060872	NO SAMPLE	ANALYZED			
112061572	N	N	N	N	N
122061572	NO SAMPLE	OBTAINED			
132061572	N	N	N	N	N
142061572	N	N	N	N	N
162061372	N	N	N	N	N
112062872	N	N	N	N	N
122062872	N	N	N	N	N
132062872	NO SAMPLE	ANALYZED			
142062872	N	N	N	N	N
212091671	N	N	N	N	N
222091671	N	N	N	N	N
232091671	N	N	N	N	N
242091671	NO SAMPLE	OBTAINED			
252091671	N	N	N	N	N
262092771	N	N	N	N	N
272092771	N	N	N	N	N
212102671	N	N	N	N	N
222102671	N	N	N	N	N
232102671	N	N	N	N	N
242102671	N	N	N	N	N
252102671	NO SAMPLE	OBTAINED			
262102671	NO SAMPLE	OBTAINED			
212120261	N	N	N	N	N
222120271	N	N	N	N	N
232120271	N	N	N	N	N
242120271	N	N	N	N	N

*See key for identification of samples and sensitivity of detection of residues on page 66

Table 17. Organophosphate Insecticide Residues in River Water and Bottom Sediment Samples.

Sample No.*	Insecticide Residue ppb				
	Diazinon	Methyl Parathion	Ethyl Parathion	Malathion	Thimet
252120271	N	N	N	N	N
262120171	N	N	N	N	N
212032472	N	N	N	N	N
222032472	N	N	N	N	N
232032472	N	N	N	N	N
242032472	N	N	N	N	N
252032472	N	N	N	N	N
262032472	N	N	N	N	N
212041872	N	N	N	N	N
222041872	NO SAMPLE	OBTAINED			
232041872	N	N	N	N	N
242041872	NO SAMPLE	OBTAINED			
252041872	N	N	N	N	N
262041972	N	N	N	N	N
212041972					
212051772	N	N	N	N	N
222051772	NO SAMPLE	OBTAINED			
232051772	N	N	N	N	N
242051772	NO SAMPLE	OBTAINED			
252051772	N	N	N	N	N
262060872	N	N	N	N	N
272060872	N	N	N	N	N
212061572	N	N	N	N	N
222061572	NO SAMPLE	ANALYZED			
232061572	N	N	N	N	N
242061572	N	N	N	N	N
252061572	N	N	N	N	N
212062872	N	N	N	N	N
222062872	N	N	N	N	N
232062872	N	N	N	N	N
242062872	N	N	N	N	N
252062872	N	N	N	N	N
362092771	N	N	N	N	N
312100471	N	N	N	N	N
322100471	NO SAMPLE	ANALYZED			
332100471	N	N	N	N	N
342100471	N	N	N	N	N
352100571	NO SAMPLE	OBTAINED			
312110871	N	N	N	N	N
322110871	N	N	N	N	N
332110871	NO SAMPLE	ANALYZED			
342110871	N	N	N	N	N
352110871	NO SAMPLE	OBTAINED			
372110871	NO SAMPLE	OBTAINED			
312121471	N	N	N	N	N
322121471	N	N	N	N	N

*See key for identification of samples and sensitivity of detection of residues on page 66

Table 17. Organophosphate Insecticide Residues in River Water and Bottom Sediment Samples.

Sample No.*	Insecticide Residue ppb				
	Diazinon	Methyl Parathion	Ethyl Parathion	Malathion	Thimet
332121471	N	N	N	N	N
342121471	N	N	N	N	N
352121471	NO SAMPLE	OBTAINED			
312032072	N	N	N	N	N
322032072	N	N	N	N	N
332032072	N	N	N	N	N
342032072	N	N	N	N	N
352032072	NO SAMPLE	OBTAINED			
312041772	NO SAMPLE	ANALYZED			
322041772	N	N	N	N	N
332041772	N	N	N	N	N
342041772	N	N	N	N	N
352041772	NO SAMPLE	OBTAINED			
312051672	N	N	N	N	N
322051672	N	N	N	N	N
332051672	N	N	N	N	N
342051672	N	N	N	N	N
352051672	NO SAMPLE	OBTAINED			
312061472	N	N	N	N	N
322061472	N	N	N	N	N
332061472	N	N	N	N	N
342061472	N	N	N	N	N
352061472	NO SAMPLE	OBTAINED			
312062772	N	N	N	N	N
322062772	N	N	N	N	N
332062772	NO SAMPLE	ANALYZED			
342062772	NO SAMPLE	ANALYZED			
352062772	NO SAMPLE	OBTAINED			
412093071	N	N	N	N	N
422093071	N	N	N	N	N
432093071	N	N	N	N	N
442093071	N	N	N	N	N
452093071	N	N	N	N	N
462093071	N	N	N	N	N
462102071	N	N	N	N	N
412110871	N	N	N	N	N
422110871	N	N	N	N	N
432110871	N	N	N	N	N
442110871	N	N	N	N	N
452110871	N	N	N	N	N
462110871	N	N	N	N	N
412121471	3.62	N	N	N	N
422121471	N	N	N	N	N
432121471	N	N	N	N	N
442121471	N	N	N	N	N
452121471	N	N	N	N	N

*See key for identification of samples and sensitivity of detection of residues on page 66

Table 17. Organophosphate Insecticide Residues in River Water and Bottom Sediment Samples.

Sample No.*	Insecticide Residue ppb				
	Diazinon	Methyl Parathion	Ethyl Parathion	Malathion	Thimet
412032072	N	N	N	N	N
422032072	N	N	N	N	N
432032072	N	N	N	N	N
442032072	N	N	N	N	N
462032072	N	N	N	N	N
412041772	N	N	N	N	N
422041772	N	N	N	N	N
432041772	N	N	N	N	N
442041772	N	N	N	N	N
452041772	N	N	N	N	N
462041772	N	N	N	N	N
412051672	N	N	N	N	N
422051672	NO SAMPLE	ANALYZED			
432051672	13.58	N	N	N	N
442051672		N	N	N	N
452051672	N	N	N	N	N
462051672		N	N	N	N
412061472	10.31	N	3.27	N	N
422061472	N	N	N	N	N
432061472	6.15	N	N	N	N
442061472	N	N	N	N	N
462061472	NO SAMPLE	OBTAINED			
412062772	7.26	N	N	N	N
422062772	N	N	N	N	N
432062772	N	N	N	N	N
442062772	N	N	N	N	N
462062772	N	N	N	N	N
512082371	NO SAMPLE	OBTAINED			
522082371	NO SAMPLE	OBTAINED			
532082371	NO SAMPLE	OBTAINED			
542082371	NO SAMPLE	OBTAINED			
552082371	NO SAMPLE	OBTAINED			
562082371	NO SAMPLE	OBTAINED			
512092371	N	N	N	N	N
522092371	N	N	N	N	N
542092371	N	N	N	N	N
552092371	N	N	N	N	N
562092371	N	N	N	N	N
572092371	NO SAMPLE	OBTAINED			
512110471	N	N	N	N	N
522110471	N	N	N	N	N
542110471	NO SAMPLE	OBTAINED			
562110471	N	N	N	N	N
572110471	NO SAMPLE	OBTAINED			
512121371	N	N	N	N	N
522121371	N	N	N	N	N

*See key for identification of samples and sensitivity of detection of residues on page 66

Table 17. Organophosphate Insecticide Residues in River Water and Bottom Sediment Samples.

Sample No.*	Insecticide Residue ppb				
	Diazinon	Methyl Parathion	Ethyl Parathion	Malathion	Thimet
542121371	NO SAMPLE	ANALYZED			
552121371	N	N	N	N	N
562121371	NO SAMPLE	ANALYZED			
572121371	NO SAMPLE	OBTAINED			
512032072	N	N	N	N	N
522032172	N	N	N	N	N
552032172	N	N	N	N	N
562032172	NO SAMPLE	OBTAINED			
572032172	NO SAMPLE	OBTAINED			
512042772	N	N	N	N	N
522042772	N	N	N	N	N
552042772	N	N	N	N	N
562042772	NO SAMPLE	OBTAINED			
572042772	NO SAMPLE	OBTAINED			
512051872	NO SAMPLE	ANALYZED			
522051872	N	N	N	N	N
542052772	N	N	N	N	N
552051872	N	N	N	N	N
562051872	NO SAMPLE	OBTAINED			
572051872	N	N	N	N	N
512061772	N	N	N	N	N
522061772	N	N	N	N	N
552061772	N	N	N	N	N
562061772	NO SAMPLE	OBTAINED			
572061872	N	N	N	N	N
512063072	N	N	N	N	N
522063072	N	N	N	N	N
552063072	N	N	N	N	N
562063072	NO SAMPLE	OBTAINED			
572063072	N	N	N	N	N

*See key for identification of samples and sensitivity of detection of residues on page 66

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